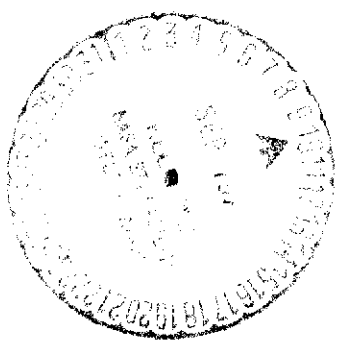
NASA SP-7037 (44)



# AERONAUTICAL ENGINEERING

## A SPECIAL BIBLIOGRAPHY WITH INDEXES

## Supplement 44



## MAY 1974

NASA SP-7037(44) Aeronautical Engineering Pages 169–201 MAY 1974

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

## ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges:

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NASA SP-7037 (44)

# AERONAUTICAL ENGINEERING

## A Special Bibliography

## Supplement 44

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in April 1974 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

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# INTRODUCTION

Under the terms of an interagency agreement with the Federal Aviation Administration this publication has been prepared by the National Aeronautics and Space Administration for the joint use of both agencies and the scientific and technical community concerned with the field of aeronautical engineering. The first issue of this bibliography was published in September 1970 and the first supplement in January 1971. Since that time, monthly supplements have been issued.

This supplement to *Aeronautical Engineering—A Special Bibliography* (NASA SP-7037) lists 249 reports, journal articles, and other documents originally announced in April 1974 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*.

The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles.

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged in two major sections, *IAA Entries* and *STAR Entries*, in that order. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the slight variation in citation appearances.

Three indexes—subject, personal author, and contract number—are included.

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All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc., (AIAA), as follows: Paper copies are available at $5.00 per document up to a maximum of 20 pages. The charge for each additional page is 25 cents. Microfiche [1] are available at the rate of $1.00 per microfiche for documents identified by the # symbol following the accession number. A number of publications, because of their special characteristics, are available only for reference in the AIAA Technical Information Service Library. Minimum airmail postage to foreign countries is $1.00. Please refer to the accession number, e.g., A74-11072, when requesting publications.

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All publications abstracted in this bibliography are available to the public through the sources as indicated in the *STAR Entries* and *IAA Entries* sections. It is suggested that the bibliography user contact his own library or other local libraries prior to ordering any publication inasmuch as many of the documents have been widely distributed by the issuing agencies, especially NASA. A listing of public collections of NASA documents is included on the inside back cover.

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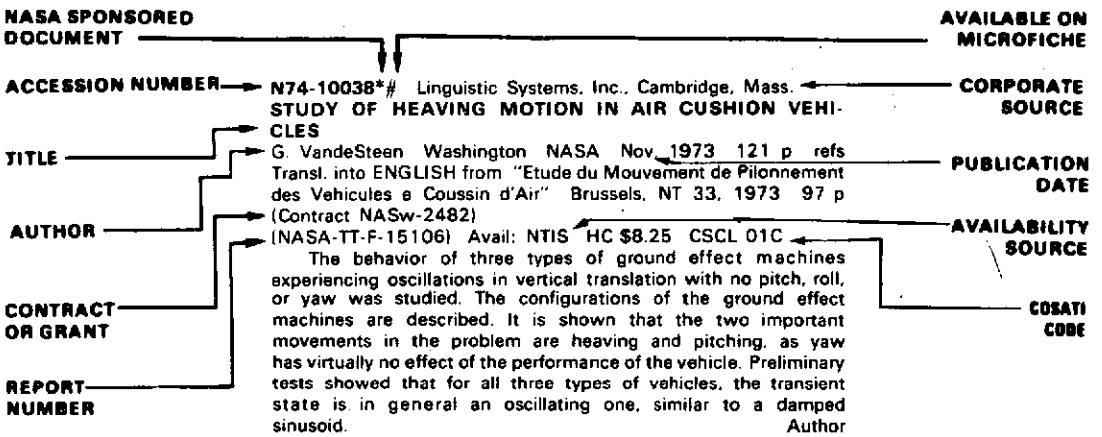


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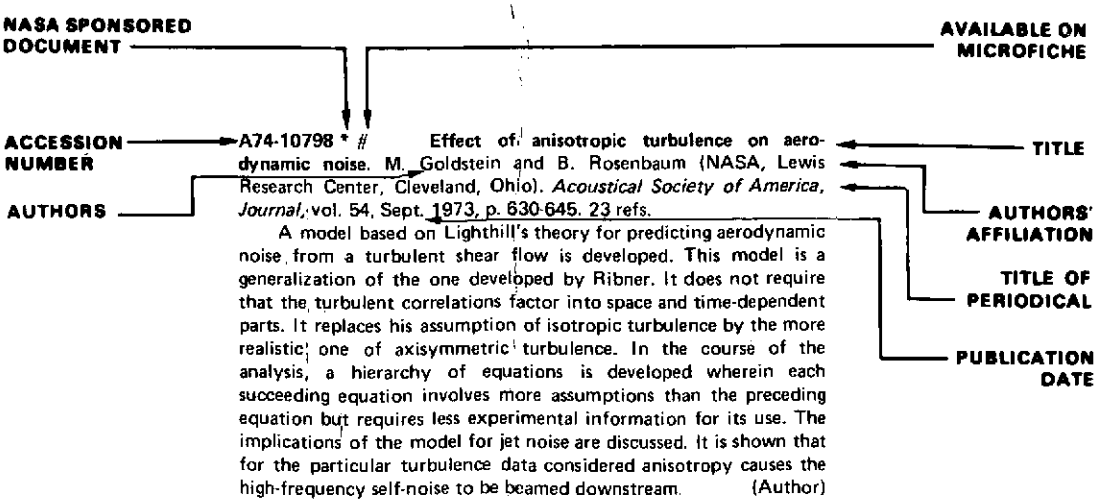

# AERONAUTICAL ENGINEERING

*A Special Bibliography (Suppl. 44)* MAY 1974


## IAA ENTRIES

**A74-19228** **Roll-plane analysis of on-aircraft antennas.** W. D. Burnside, R. J. Marhefka, and C. L. Yu (Ohio State University, Columbus, Ohio). *IEEE Transactions on Antennas and Propagation*, vol. AP-21, Nov. 1973, p. 780-786. 8 refs. Contract No. N62269-72-C-0354.

The roll-plane radiation patterns of on-aircraft antennas are analyzed using high-frequency solutions. This is a basic study of aircraft-antenna pattern performance in which the aircraft is modeled in its most basic form. The fuselage is assumed to be a perfectly conducting circular cylinder with the antennas mounted near the top or bottom. The wings are simulated by arbitrarily many-sided flat plates and the engines by circular cylinders. The patterns in each case are verified by measured results taken on simple models as well as scale models of actual aircraft. (Author)

**A74-19259** **Photoelastic analysis of the stress field surrounding a fatigue crack.** A. Berkovits, A. A. Betser, and A. Assa (Technion - Israel Institute of Technology, Haifa, Israel). *Experimental Mechanics*, vol. 14, Feb. 1974, p. 64-68. 9 refs.

A photoelastic analysis was carried out on plane polyester specimens containing a fatigue crack, in order to study the effect of plastic yielding around the crack tip on the elastic stress distribution in the vicinity of the crack. In general, results were in good agreement with values calculated for the case of a sharp-tipped crack. However, very near the crack tip, principal stresses obtained experimentally were slightly lower than calculated stresses, probably due to the bluntness of the fatigue crack. Also lines of constant stress tended to move behind the crack tip, in contrast with the calculated stresses, which occurred further forward over the field of investigation. (Author)

**A74-19315** **Recent advances in air traffic control radars.** C. E. Muehe (MIT, Lexington, Mass.). In: NEREM 73; Northeast Electronics Research and Engineering Meeting, Boston, Mass., November 6-8, 1973, Record. Part 1. Newton, Mass., Institute of Electrical and Electronics Engineers, Inc., 1973, p. 96-99. U.S. Department of Transportation Contract No. FA72WAI-242; Contract No. F19628-73-C-0002.

Recent improvements in microwave radars used for air traffic control are described. The reviewed improvement varieties include: (1) radar parameter changes that increase the target-to-clutter ratio at the input of the radar; (2) efforts aimed at maintaining or improving the correlation from pulse to pulse of both target and clutter returns; and (3) optimizing filtering and thresholding. M.V.E.

**A74-19317** **The national Microwave Landing System.** J. W. Edwards (FAA, Microwave Landing System Branch, Washington, D.C.). In: NEREM 73; Northeast Electronics Research and Engineering Meeting, Boston, Mass., November 6-8, 1973, Record. Part 1. Newton, Mass., Institute of Electrical and Electronics Engineers, Inc., 1973, p. 212-215.

Discussion of some of the advanced capabilities of the Microwave Landing System (MLS) now under development and scheduled for initial operational implementation in 1978. Following a description of the system, its operational capabilities are reviewed. Special attention is given to the initial approach, final approach, flareout, landing and rollout, missed approach and departure guidance. M.V.E.

**A74-19353** # **Hydrogen - Make-sense fuel for an American supersonic transport.** W. J. D. Escher (Escher Technology Associates, St. Johns, Mich.) and G. D. Brewer (Lockheed-California Co., Burbank, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 12th, Washington, D.C., Jan. 30-Feb. 1, 1974, Paper 74-163.* 11 p. 21 refs. Members, $1.50; nonmembers, $2.00.

Arguments in favor of the use of liquid-hydrogen fuel for power supersonic transport aircraft are presented, with a view toward the 'better and faster' SST the U.S. will eventually build. It is seen that, in addition to the economic and operational advantages, the use of hydrogen will establish a sound basis for evolving out of the present self-limited petroleum era into tomorrow's hydrogen economy. V.P.

**A74-19370** # **Equipment for aircraft and helicopter technical servicing (Agregaty tekhnicheskogo obsluzhivaniia samoletov i vertoletov).** V. A. Egorychëv, E. I. Osokin, and E. D. Khachikian. Moscow, Izdatel'stvo Transport, 1973. 200 p. 35 refs. In Russian.

The specifics of some standard mobile aircraft servicing and maintenance equipment used at Soviet airports are discussed. Particular attention is given to the APA-50, APA-50M, and APA-100 electric generators; the UPG-250 and UPG-300 universal hydroelectric generators; the EGU-3 maintenance and servicing vehicle providing electric, hydraulic, and pneumatic power; the UBZ and UBZ-2 pneumatic starter systems, and the universal AZZM2 refueling and working-fluid supply vehicle. V.P.

**A74-19371** # **Parameters of RF flight navigation aids and their measurement (Parametry radionavigatsionnykh sredstv obespecheniia poletov i ikh izmerenie).** V. E. Panagriev, A. A. Sosnovskii, and I. A. Khaimovich. Moscow, Izdatel'stvo Transport, 1973. 384 p. In Russian.

Description of Soviet domestic and international standards and recommended procedures for ground-based and in-flight testing of RF navigation equipment employed in civil aviation. Operating principles of radio direction finders, altimeters, and beacon systems are described along with alignment procedures and accuracy control tests. Precision requirements posed for instrument landing systems are related with flight safety and traffic control aspects of modern airport operations. T.M.

**A74-19372 # Collection of problems on airplane piloting /4th revised and enlarged edition/ (Sbornik zadach po samoletovozhdeniiu /4th revised and enlarged edition/).** A. A. Leizerakh. Moscow, Izdatel'stvo Transport, 1973. 319 p. In Russian.

Description of underlying theoretical considerations and recommended practical procedures for piloting and navigation of jet airplanes in a variety of flight situations involving mild and adverse weather conditions in daytime and nighttime periods. Position, velocity, and course measurements used to provide data for navigation are explained, and typical navigation problems and solutions are described for cases involving the use of various on-board and ground-based navigation aids. T.M.

**A74-19374 # Flight vehicle control systems (Sistemy upravleniia letatel'nymi apparatami).** V. A. Bodner. Moscow, Izdatel'stvo Mashinostroenie, 1973. 504 p. 33 refs. In Russian.

Theoretical problems, design principles, structural features, and applications of automatic flight vehicle control systems are discussed. The theory of automatic control of angular motions, center-of-mass motion, motion during landing approach, and during formation flight is considered. Problems of technical realization of control systems and problems of complex automation of aircraft through the use of onboard computers are examined. Particular attention is paid to automatic control systems for rockets and spacecraft. A number of other problems which have been widely discussed in the literature are also considered, including the use of in-built devices for monitoring control systems, methods and technical means of increasing flight safety during automatic control, and the problem of flight control at low altitudes. A.B.K.

**A74-19376 Component performance and systems applications of surface acoustic wave devices; Proceedings of the International Specialist Seminar, Aviemore, Scotland, September 25-28, 1973.** Seminar sponsored by the Institution of Electrical Engineers. Stevenage, Herts., England, Institution of Electrical Engineers (IEE Conference Publication, No. 109), 1973. 370 p. $25.35.

Subjects in the area of materials and fabrication are considered, taking into account materials for surface acoustic wave components, the role of layered structures in surface acoustic wave technology, fabrication techniques for surface acoustic wave devices, and the economics of producing SAW materials for volume production. Other topics investigated are related to acoustic subsystems, programmable devices, filters, radar applications of SAW, digital signal processing, and communication systems. ATC applications are also discussed, giving attention to the reduction of garbling in secondary surveillance radar, high integrity ATC data links, and the application of SAW devices to an integrated communications, navigation, identification system for air traffic control. G.R.

**A74-19388 Applications of surface wave devices.** J. D. Maines (Royal Radar Establishment, Malvern, Worcs., England). In: Component performance and systems applications of surface acoustic wave devices; Proceedings of the International Specialist Seminar, Aviemore, Scotland, September 25-28, 1973. Stevenage, Herts., England, Institution of Electrical Engineers, 1973, p. 191-201. 21 refs.

SAW devices and their significance in systems are considered, giving attention to nondispersive fixed delay, band pass filters, SAW oscillators, matched filters, programmable matched filters, variable delay lines, and devices derived from multistrip couplers. The use of SAW devices for particular systems applications is discussed, taking into account pulse compression radar, pseudo coherent radars, fusing systems, novel devices, communication applications, spread spectrum communications, and applications to ATC. G.R.

**A74-19390 Problems in civil air traffic control which SAW technology may impact.** J. O. Clark (British Airways Board, London, England). In: Component performance and systems applications of surface acoustic wave devices; Proceedings of the International Specialist Seminar, Aviemore, Scotland, September 25-28, 1973. Stevenage, Herts., England, Institution of Electrical Engineers, 1973, p. 333-336.

General discussion of potentially promising applications of surface acoustic wave devices to improve the performance of electronics hardware in air traffic control systems. The more important uses considered include the reduction of garbling problems with secondary surveillance radars, modulation concepts for high-integrity data transmission systems, and development of integrated military communications systems. T.M.

**A74-19391 The reduction of garbling in secondary surveillance radar.** G. L. Moule (Royal Radar Establishment, Malvern, Worcs., England). In: Component performance and systems applications of surface acoustic wave devices; Proceedings of the International Specialist Seminar, Aviemore, Scotland, September 25-28, 1973. Stevenage, Herts., England, Institution of Electrical Engineers, 1973, p. 337-344.

An investigation is conducted concerning the possibility to develop a system which uses surface acoustic wave tapped delay lines as linear analog matched filters to provide a correlation between the received pulse train and a preset code. The employment of such a system would have the advantage that the existing transponder signals could be used. Modifications would be required only in the case of those controller ground stations for which garbling is a problem. Details concerning the surface acoustic wave subsystem are considered, giving attention to the basic approach, the experimental subsystem, and some experimental results. It is pointed out that further improvements regarding the garbling problem can be made by making use of the transponder reply characteristics. G.R.

**A74-19392 High integrity ATC data links.** B. D. Parker (Dollman Electronics, Ltd., Biggin Hill, Kent, England). In: Component performance and systems applications of surface acoustic wave devices; Proceedings of the International Specialist Seminar, Aviemore, Scotland, September 25-28, 1973. Stevenage, Herts., England, Institution of Electrical Engineers, 1973, p. 345-354.

Experiments between an aircraft and a ground station have shown that a microwave system based on a well proven four-signature encoding technique, together with surface acoustic wave devices (to carry the four signatures) offers high integrity data transfer for fixed length messages. In addition, the band spread coding offered by the SAW (Surface Acoustic Wave) AMF (Analogue Matched Filters) technique provides improved detection probability with an inbuilt level of signal privacy. The combination of these two fully asynchronous techniques with a hardware-proven L band equipment presents a significant advance in data communications. The splitting of traffic into message blocks (already a well established technique) can be combined with automatic request for repeats (ARQ) to rectify detection errors. These data links could seriously impact many areas of point to point data communications. V.P.

**A74-19464 The technology and application of free-space power transmission by microwave beam.** W. C. Brown (Raytheon Co., Microwave and Power Tube Div., Waltham, Mass.). *IEEE, Proceedings*, vol. 62, Jan. 1974, p. 11-25. 30 refs.

The point-to-point transfer of power by a microwave beam is an emerging technology with several unique characteristics and applications. The technology is examined in terms of the microwave beam itself, and the conversion technology between microwaves and dc power at either end of the system. The existing efficiencies and the projected efficiencies for the overall system and its elements are emphasized. The procedure for designing a highly efficient microwave beam power transfer system of arbitrary length starting from the microwave generator and terminating with the receiving aperture is given. The potential applications are discussed in terms of the unique characteristics of microwave power transmission. The successful experimental work on microwave-powered helicopters is reviewed. A potential application to bring down power from space is examined. (Author)

**A74-19471** # **Trends in hydraulic systems of commercial transport aircraft.** M. Alban (Société Messier-Hispano, Montrouge, Hauts-de-Seine, France). *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper.* 23 p.

A review of developments in commercial aircraft design shows that two trends are currently observed in the aircraft industry. Hydraulics are increasingly associated to electrical and electronic technology in all systems designed for excellent dynamic performance, whereas use of mechanicohydraulic and electrohydraulic systems is made in simple sequentially operating automatic systems. Integrated systems and systems using digital circuits are receiving increased attention. This technological development is accompanied by regulations aimed at improving air transport safety. V.P.

**A74-19476** # **Noise problems in airport design and in civil aircraft operation.** N. Damonte (Genova, Università, Genoa, Italy). *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper.* 30 p. 9 refs. In Italian.

Consideration of noise problems caused by aircraft not only in the vicinity of airports but also beyond the takeoff and approach areas. A need has arisen to gain a better and more exact knowledge of the ways and means for a quantitative assessment of the real noise disturbance caused to the population by overflying aircraft. In the specific case of aircraft noise recurring at certain intervals, it is concluded that the measuring standard providing the best indication of real disturbance caused to man is the 'NNI' system, which besides measuring the noise intensity and spectrum frequency also takes into account round-the-clock noise intermittence. Based upon the foregoing, it has been rather easy to demonstrate that the noise disturbance caused by incoming and outgoing aircraft is affecting a growing number of people as the distance from the airport increases, since the noise is spreading over an ever growing area, obviously up to the point in which lateral noise propagation is counterbalanced by its reduced intensity due to the increased flight altitude of the aircraft. Noise pollution caused by aircraft is currently being tackled from two sides at the same time. First of all, by reducing noisiness at the source by the utilization of bypass engines with a high dilution ratio developed according to highly sophisticated soundproofing techniques and, secondly, by adopting special antinoise operating procedures during the night in some airports. (Author)

**A74-19479** # **Energy problems in air transportation.** G. E. Lundquist (FAA, Washington, D.C.). *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper.* 25 p. 9 refs.

Energy development and usage are worldwide problems. The prospects of energy supply and demand over the long term indicate a critical impact on air transportation. Unless energy is conserved through various alternative actions, air transportation will suffer. This paper analyzes options for reducing demand, for improving efficiency, and for diversifying, both through alternative fuels and transportation modes, for the near term (one to 15 years) and the 15-year plus time frame. These options offer a 30 to 50% reduction in projected fuel requirements. (Author)

**A74-19481** # **Airports evolution and qualification (Evoluzione e qualificazione degli aeroporti).** G. Pezzani. *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper.* 27 p. 14 refs. In Italian.

The years 1950s and 1960s which mark the beginning of the air transportation industry, were decisive for airport structure through the realization of suitable flight and operational infrastructure capable of assuming practicability and receptivity. The 1970s with jumbo jets have new problems of dimensions and qualification for large airports together with problems of accessibility and ecology. Thus it is necessary to consider if the way followed until now, which leads to the superairport, does not have to be reexamined for a different solution to the problem of qualified airport systems. In the 1980s and thereafter, in addition to the use of atomic energy in air transportation, a new and unforeseeable leap will be made with mercantile aircraft. (Author)

**A74-19486** # **The implications for air transportation of energy shortage.** L. A. Mountford and R. E. Williams (Shell International Petroleum Co., Ltd., London, England). *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper.* 25 p.

After referring to the enormous increase in air transport during the last twenty years, encouraged by the considerable availability of low cost fuel, the authors discuss the problems and difficulties which may in the near future affect the aviation market's oil supplies. The more demanding quality requirements and the ever growing needs of light distillates by all the other markets are taken into consideration. Attention is given, moreover, to the possibilities open to the oil companies, aircraft manufacturers, and airline operators in order to moderate and alleviate this critical situation. (Author)

**A74-19487** # **Future advanced-technology aircraft in the context of an integrated transport system (I futuri aeromobili a tecnologie avanzate nel quadro di un sistema di trasporti integrato).** V. Correnti. *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper.* 32 p. In Italian.

The development of worldwide air transportation is conditioned by the technical evolution of aircraft and by their integration into the global transport system. The trends of this evolution are examined on the basis of reasonable predections for the next ten years. Reference is made to the development of new subsonic aircraft having greatly improved acceptability and integration characteristics from the economic point of view. (Author)

**A74-19489** **F-15 progress report. II.** I. L. Burrows (USAF, Edwards AFB, Calif.; McDonnell Douglas Corp., St. Louis, Mo.). *(Society of Experimental Test Pilots, Symposium, 17th, Beverly Hills, Calif., Sept. 26-29, 1973.) Society of Experimental Test Pilots, Technical Review*, vol. 11, no. 4, 1974, p. 13-22.

Flight test and performance data as obtained for the aircraft during the preceding year are reported, giving attention to difficulties concerning the maneuvering forces, lateral sensitivity problems, and questions with respect to cross wind landings. The approaches used for overcoming the difficulties concerning the control of the aircraft are discussed. Tables and graphs showing the aircraft flight history, the flight test status, and the control characteristics of the aircraft are presented. G.R.

**A74-19490** **Longitudinal stability for supersonic transport aircraft.** T. D. Benefield (USAF; FAA, Washington, D.C.) and R. Abrams (Rockwell International Corp., El Segundo, Calif.). *(Society of Experimental Test Pilots, Symposium, 17th, Beverly Hills, Calif., Sept. 26-29, 1973.) Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 4, 1974, p. 23-32.

In November 1972, a Federal Aviation Administration flight test team was engaged in a flight test program to evaluate as a primary objective the Concorde's supersonic static longitudinal stability characteristics. Two major secondary objectives were to evaluate the aircraft's static longitudinal stability characteristics in the landing configuration under failure conditions and to evaluate the aircraft's stall prevention system. G.R.

**A74-19491** **FAA certification of the S-58T helicopter for instrument flight. I.** J. R. Wright (United Aircraft Corp., Sikorsky Aircraft Div., Stratford, Conn.). *(Society of Experimental Test Pilots, Symposium, 17th, Beverly Hills, Calif., Sept. 26-29, 1973.) Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 4, 1974, p. 35-40.

The first flight of the S-58 took place in 1954. The aircraft was originally designed and produced for the U.S. Navy as an antisubmarine-warfare helicopter employing dip sonar. Subsequently, it was manufactured for the Marines and for the Army. The change from the S-58 to the S-58T basically involves an engine modification to add extended life and usefulness to an already proven helicopter. An IFR Certification Program Outline concerning the S-58T was presented in July of 1972. Details of the flight test program are discussed together with questions of aircraft avionics. G.R.

**A74-19492** **FAA certification of the S-58T helicopter for instrument flight. II.** J. J. Shapley (FAA, Flight Standards Div., Burlington, Mass.). *(Society of Experimental Test Pilots, Symposium, 17th, Beverly Hills, Calif., Sept. 26-29, 1973.) Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 4, 1974, p. 41-44.

The applicable Federal Air Regulation for the FAA certification states that the Rotorcraft must have any additional characteristics required for night or Instrument Operation if certification for those kinds of operation is requested. In addition there are Interim Standards for Helicopter Instrument Flight Requirements. Current test guidelines are considered together with various items of interest during the certification program. G.R.

**A74-19496** **S-3A initial operational test and evaluation.** C. W. Walck (U.S. Navy, Air ASW Section, Norfolk, Va.). *(Society of Experimental Test Pilots, Symposium, 17th, Beverly Hills, Calif., Sept. 26-29, 1973.) Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 4, 1974, p. 69-78.

The various stages in the S-3A program are discussed, giving attention to the standard operating procedure prior to November 1971 and developments after this date. In the year that elapsed from initial efforts to inaugurate the Initial Operational Test and Evaluation (IOT and E) procedure until the first combined test effort in November 1972 many noteworthy achievements were amassed by the integrated S-3A Test Team. Conclusions drawn on the basis of nearly two years experience with IOT and E are discussed, giving attention also to effects of IOT and E on the contractor. G.R.

**A74-19497** **Putting the computer in its place.** T. M. Kastner (Grumman Aerospace Corp., Bethpage, N.Y.) and R. P. LeCann (Grumman Data Systems Corp., Bethpage, N.Y.). *(Society of Experimental Test Pilots, Symposium, 17th, Beverly Hills, Calif., Sept. 26-29, 1973.) Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 4, 1974, p. 143-164.

This presentation describes the development and operational employment of an advanced, flight test, data system by the Grumman Aerospace Corporation. The system known as ATS (Automated Telemetry System) is viewed in terms of its conceptual requirements, design and construction, operational checkout, and use in the development testing of the F-14A Tomcat. Lessons learned are presented as they relate to the roles of the engineer, pilot, and management. In addition to specific conclusions in the above areas, it is generalized that this and similar systems represent the thrust of future technology in the field of flight testing. (Author)

**A74-19498** **Vectored thrust V/STOL shipboard testing.** J. E. Iles (U.S. Navy, MCAS Beaufort, S.C.). *(Society of Experimental Test Pilots, Symposium, 17th, Beverly Hills, Calif., Sept. 26-29, 1973.) Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 4, 1974, p. 165-178. 5 refs.

The AV-SA Harrier and two test ships of the LPH-2 class were used in the investigation. The AV-SA Harrier is a single seat, transonic, light attack aircraft with a vertical/short take-off and landing capability. Two models of the Pegasus engine were tested. Standard carrier suitability test methods were used when applicable. The results of the investigation are discussed, giving attention to workload, minimum ceiling and visibility, performance characteristics, and questions of control capability. G.R.

**A74-19499** **The case for engine flying test beds.** J. H. Pollitt (Rolls-Royce /1971/, Ltd., Derby, England). *(Society of Experimental Test Pilots, Symposium, 17th, Beverly Hills, Calif., Sept. 26-29, 1973.) Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 4, 1974, p. 179-187.

It is pointed out that there is the need for an improvised vehicle to undertake flight evaluation if the development of an engine precedes or is done simultaneously with the manufacture and development of the aircraft. In this case either a Flying Test Bed (FTB) or an Altitude Test Facility, or both can be used. Initial difficulties experienced with FTB's are considered together with the approaches used for overcoming these difficulties. It has been found that the type of installation which will give good results will depend on the development state of the engine. G.R.

**A74-19500** **BD-5 flight test program report.** L. H. Berven (Bede Aircraft, Inc., Newton, Kan.). *(Society of Experimental Test Pilots, Symposium, 17th, Beverly Hills, Calif., Sept. 26-29, 1973.) Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 4, 1974, p. 201-209.

The BD-5 is an amateur-built general aviation aircraft which represents a new concept in sport aviation. The new aircraft is basically a single-place, low wing monoplane pusher with several unique design characteristics. Development flight tests are discussed together with instrumentation, flying qualities, lateral/directional stability, stalls, current flight tests, and the little turbojet engine selected for the aircraft. G.R.

**A74-19629** # **Some problems associated with noise attenuation at jet engine test facilities (O pewnych zagadnieniach zwiazanych z tlumieniem halasu w hamowniach silnikow odrzutowych).** S. Augustyniak, H. Kaczmarek, and J. Bartoszak (Poznan, Politechnika; BIPROMASZ, Poznan, Poland). In: Conference on the Topic of Combatting Noise, 3rd, Warsaw, Poland, November 5-8, 1973, Proceedings. Warsaw, Polska Akademia Nauk, 1973, p. 14-18. In Polish.

**A74-19631** # **Analysis of axisymmetric turbulence relevant to jet noise.** H. V. Fuchs (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Turbulenzforschung, Berlin, West Germany). In: Conference on the Topic of Combatting Noise, 3rd, Warsaw, Poland, November 5-8, 1973, Proceedings. Warsaw, Polska Akademia Nauk, 1973, p. 125-129. 6 refs.

Pressure probes were positioned downstream from a jet source in a plane normal to the jet axis at and away from the latter. A correlation analysis of the measurements was carried out in an

attempt to separate (for a given narrow frequency band) the axisymmetric content of the turbulent pressure field from all the other disturbances (including those which may be realistically described by some sort of isotropic model). Graphs illustrate the variation of the axisymmetric spectrum of the pressure fluctuation with distance from the jet axis. T.M.

**A74-19638** # **Statistical analysis of aircraft noise levels (Analiza statystyczna poziomu dzwieku halasu lotniczego).** T. Rajpert (Zarzad Lotniskowy, Warsaw, Poland). In: Conference on the Topic of Combatting Noise, 3rd, Warsaw, Poland, November 5-8, 1973, Proceedings. Warsaw, Polska Akademia Nauk, 1973, p. 267-273. In Polish.

A statistical analysis of aircraft noise level fluctuations at Okecie Airport (Warsaw) has been used to determine temporal distributions of noise levels corresponding to starting and landing aircraft. It is shown that correlation of these statistical data with other pertinent factors (aircraft weight and various atmospheric parameters) can be used to define the effects of ambient conditions on airport noise levels and to compare the noise properties of different aircraft. T.M.

**A74-19684** **Flexible lifting surfaces (Surfaces portantes souples).** P. Vaussy (Ecole Nationale Supérieure de Mécanique, Nantes, France). *(Association Technique Maritime et Aéronautique, Session, 73rd, Paris, France, May 14-18, 1973.) Association Technique Maritime et Aéronautique, Bulletin,* no. 73, 1973, p. 361-394; Discussion, p. 395, 396. 12 refs. In French.

Consideration of a steady flow of an inviscid compressible fluid, uniform ad infinitum, about two flexible, though inextensible, surfaces. Each surface consists of a rectangular membrane supported by rectilinear and parallel leading and trailing edges. Using an integral lifting-surface equation and general membrane-equilibrium equations, a linearized computation method is developed. Lift, induced drag, and moment coefficient variations are investigated for various configurations. M.V.E.

**A74-19690** **Helicopter applications at sea (Les applications maritimes de l'hélicoptère).** A. Renaud. *(Association Technique Maritime et Aéronautique, Session, 73rd, Paris, France, May 14-18, 1973.) Association Technique Maritime et Aéronautique, Bulletin,* no. 73, 1973, p. 621-632; Discussion, p. 633-638. In French.

Current and future applications of the helicopter at sea are reviewed for both military and commercial service tasks. Discussed missions include rescue, antisubmarine warfare, mine sweeping, the deposition of pilots on merchant ships at sea or of personnel and supplies on oil-drilling ocean platforms. Some of the navigation and safety problems involved are examined. M.V.E.

**A74-19726** **The fuel crisis and the controller.** J. E. McNamara (Air Transport Association of America, Washington, D.C.). *Journal of Air Traffic Control,* vol. 16, Jan.-Feb. 1974, p. 5-9.

The effectiveness of the use of optimum flight profiles as a means of reducing the fuel crisis is studied on the basis of selected performance data for the B-727-200 series aircraft. It is shown that the success of airline fuel conservation programs will depend on the controller and the facility planner. A discussion of a method of measuring fuel savings shows that a descent profile must be applied to existing procedures to determine where these savings can be realized. V.P.

**A74-19727** **A look at the British ATC scene. II.** L. S. Vass. *Journal of Air Traffic Control,* vol. 16, Jan.-Feb. 1974, p. 26-29.

The Mediator system, currently in operation at the London ATC Center (LATCC) is discussed. Mediator is the code name given to the ATC portion of a joint air defense/ATC control radar system for the UK. Primary and secondary radar data is input to LATCC from 23-cm and 50-cm radars located on the London airport, and from remotely linked strategic radars in the country. SST preparations, now in progress, are examined, which include a planned substitution of semivertical radar displays for the present horizontal ones. Some aspects of the consolidation and refinement of the Mediator system expected during the next decade are discussed. The possibility of solving traffic flow problems by implementing flow control schemes between nations in Europe is examined. V.P.

**A74-19751** # **Lockheed S-3A avionics - Three system digital flight guidance.** *Aircraft Engineering,* vol. 46, Jan. 1974, p. 4-8.

The system consists of three systems integrated into one: automatic flight control system, central air data system, and flight display and interface system. Although integrated for interface compatibility, the three are here considered separately. In addition to the flight guidance system, an analog-to-digital signal conditioner is provided that is used with the magnetic anomaly detector system. There are also solid-state servomechanism position indicators. F.R.L.

**A74-19753** # **Lockheed S-3A avionics - Tactical voice and data communication.** *Aircraft Engineering,* vol. 46, Jan. 1974, p. 13, 16, 17.

All units feature in-flight performance monitoring and faults isolation. They are fully compatible with versatile avionics shop test maintenance techniques and are adaptable to general purpose automatic test systems. Predicted mean time to repair (MTTR) at the organizational level is on the order of 10 min. Cost-effectiveness and logistical benefits are obtained through a high degree of commonality among assemblies and components, which reaches as high as 90% at the card level. The main elements of the tactical communication system are the UHF transceiver, the control unit, the radio set, the HF antenna coupler, and the data terminal set. F.R.L.

**A74-19754** # **Lockheed S-3A avionics - Transmitting data by multiprocessor computer.** *Aircraft Engineering,* vol. 46, Jan. 1974, p. 21-24.

A system is described which is not only capable of working in a self-sufficient manner aboard a patrolling aircraft, but also has the ability to transmit large quantities of data to a command complex for evaluation and subsequent use in making operational decisions. Aboard the aircraft a variety of avionics sensors and subsystems is controlled by the computer. The system processes information for display, maintains weapon and search stores inventories, computes and provides weapon release commands, maintains position status, keeps mission records, and assists in classification of acoustic data. Multipurpose cathode ray tube displays provide the crew members with the information necessary to carry out their control functions during the ASW missions. Information supplied to the computer comes from the acoustic data processor, the various ASW sensors, the crew, and the onboard communication and navigation equipment. F.R.L.

**A74-19777** * # **Flowfield analysis for successive oblique shock wave-turbulent boundary-layer interactions.** C.-C. Sun and M. E. Childs (Washington, University, Seattle, Wash.). *Journal of Aircraft,* vol. 11, Jan. 1974, p. 54-59. 8 refs. Grant No. NGR-48-002-047.

Description of a procedure for predicting the flowfields that develop when successive interactions between oblique shock waves and a turbulent boundary layer occur. Such interactions may occur, for example, in engine inlets for supersonic aircraft. A control volume analysis is used to predict changes in the flow field across the interactions. Two bleed flow models are considered. The predicted results are compared with measured results and are shown to be in

good agreement when the bleed flow rate is low, or when there is no bleed. Shortcomings of the bleed flow models at higher bleed flow rates are discussed. M.V.E.

**A74-19778** # **Trailing vortex effects on following aircraft.** J. D. Iversen (Iowa State University of Science and Technology, Ames, Iowa) and S. Bernstein (Washington, University, Seattle, Wash.). *Journal of Aircraft*, vol. 11, Jan. 1974, p. 60, 61. Contract No. F44620-69-C.

Two one-hundredth scale unpowered models of the Lockheed C-130 transport aircraft were tested in a three-dimensional smoke tunnel. A smoke stream was directed at the nose of the leading model. The approximate vertical location of the trailing model relative to the wake of the leading model could then be obtained from photographs. A simple strip theory technique was used to calculate lift and rolling moment on a trailing aircraft flying at various positions relative to the vortex trail. G.R.

**A74-19852** # **A study of the characteristics of measuring elements of pneumonic systems (Issledovanie kharakteristik izmeritel'nykh elementov sistem pnevmoniki).** L. A. Zalmanzon (Akademiia Nauk SSSR, Institut Problem Upravleniia /Avtomatiki i Telemekhaniki/, Moscow, USSR). *B'lgarska Akademiia na Naukite, International Fluidics Conference, 4th, Varna, Bulgaria, Oct. 14-18, 1972, Paper.* 10 p. 6 refs. In Russian.

The results and analysis of restrictor and jet elements used for position measurement and indication are presented. A procedure for calculating systems containing these elements is described. (Author)

**A74-19859** # **Investigations into the possibilities of applying the 'Aerodynamic Paradoxon' principle in fluidic devices.** V. Tesar (Ceske Vysoke Uceni Technicke, Prague, Czechoslovakia). *B'lgarska Akademiia na Naukite, International Fluidics Conference, 4th, Varna, Bulgaria, Oct. 14-18, 1972, Paper.* 32 p.

A line of new, reed-type fluidic elements is proposed and investigated. The results of an experimental investigation of their basic properties led to the construction of a multipurpose fluidic two-port element functional prototype, which was successfully demonstrated to be able to function alternatively as a stable oscillation generator, as a fluidic/electric transducer or flow sensor with electric pulse-frequency output, and as a diode. Also investigated was a model of a mechanically tunable oscillator and a three-port, fluidically controlled oscillator element, which is also capable of functioning as a miniature logic element or flow sensor with pulse-frequency fluidic output. (Author)

**A74-19884** # **A new pneumatic hybrid control system.** A. Boros, L. Helm, Z. Marton, and A. Szucs (Magyar Tudomanyos Akademia, Automatizalasi Kutato Intezet, Budapest, Hungary). *B'lgarska Akademiia na Naukite, International Fluidics Conference, 4th, Varna, Bulgaria, Oct. 14-18, 1972, Paper.* 20 p.

Reduction of air consumption is an important problem when designing a pneumatic element or system. This question has become more important as pure fluidics have been developed. Though consumption can be reduced to a certain level by the use of turbulence amplifiers, this is not a complete solution to the problem. Using Coanda elements a tendency can be observed to lower consumption by reducing nozzle sizes and supply pressure. It is known that neither the first nor the second can be achieved over every limit because of different reasons involving fluid mechanics, element manufacturing, reliability, etc. An attempt was made to find a solution from the point of view of system techniques. A hybrid system is described. F.R.L.

**A74-19908** **The effect of interfering signals on the performance of angle of arrival estimates.** T. P. McGarty (MIT, Lexington, Mass.). *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-10, Jan. 1974, p. 70-77. 19 refs. FAA-supported research.

The performance of angle of arrival estimates using an array in the presence of interfering signals is evaluated using the Cramer-Rao bound. To do this, a model for interference is developed which presents the interference as narrowband, temporally white, but spatially correlated, noise. The bound is evaluated and it is shown to depend upon the ambiguity function of the array and spatial correlation matrix of the noise plus interference. Motivation of the model in the context of air traffic control and sonar surveillance is presented. (Author)

**A74-19915** **Electromagnetic effects of aircraft wake-active feuillet interaction.** A. J. Kelly (Princeton University, Princeton, N.J.) and M. Handelsman (Vermont University, Burlington, Vt.). *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-10, Jan. 1974, p. 136-143. 14 refs.

A mechanism by which an aircraft wake can interact strongly with the electromagnetic radiation present in an active elevated anomalous refractivity region (active feuillet) is analyzed. The aircraft wake structure, assumed to consist of twin contrarotating vortices plus entrained irrotational gas, trailing behind the wings of typical large aircraft is shown to be capable of descending a distance of approximately three wing span distances and attaining a length of the order of 10 km, prior to instability-induced disruption. The parcel of air such a descending coherent wake structures can convey into an active feuillet is demonstrated to alter significantly the local refractive index of the duct and induce substantial radiation spillage. The general characteristics of the electromagnetic radiation produced by this interaction process (i.e., scattering by diaphanous objects) is described. (Author)

**A74-19935** # **Calculation of supersonic flow past conical bodies (K raschetu sverkhzvukovogo obtekaniia konicheskikh tel).** M. Ia. Ivanov and A. N. Kraiko. *Zhurnal Vychislitel'noi Matematiki i Matematicheskoi Fiziki*, vol. 13, Nov.-Dec. 1973, p. 1557-1572. 17 refs. In Russian.

Application of a finite-difference scheme to the calculation of three-dimensional supersonic flows past various types of conical bodies, including circular, elliptic, and near-pyramidal cones; V-shaped and delta wings; and a combination of a delta wing and a circular cone. In this case the solutions describing the corresponding conical flows are developed in a process of buildup along a radial coordinate. The difference scheme employed is a straight-through scheme, which makes it possible to perform the calculation without specially determining the internal shock waves which are formed, for example, on the leeward (shadow) side of the cones at fairly large angles of attack. At the same time, the calculation of the head shock wave does not require the incorporation of any additional algorithm into the computer program, since the calculation of shock waves is one of the elements of the proposed difference scheme. A.B.K.

**A74-19957** **Some transmission characteristics of AEROSAT-type air traffic control systems (Certains aspects des transmissions dans les systèmes de controle de trafic aérien du type AEROSAT).** P. Bréant, G. David, and C. Olier (Télécommunications Radioélectriques et Téléphoniques, Paris, France). In: International Conference on Numerical Telecommunications by Satellite, 2nd, Paris, France, November 28-30, 1972, Proceedings. Paris, Editions Chiron, 1972, p. 50-59. 12 refs. In French.

The digital transmission advantages of geostationary-satellite aided, AEROSAT-type air traffic control systems are reviewed. It is shown that such systems benefit greatly from the flexibility afforded by the interchangeability of telephone and data transmission channels, and that the telemetry function accrues as a by-product of the transmission method. M.V.E.

**A74-20039** # **Atmospheric ozone - Possible impact on stratospheric aviation.** M. B. McElroy, J. E. Penner, J. C. McConnell (Harvard University, Cambridge, Mass.), and S. C. Wofsy (Harvard University; Smithsonian Astrophysical Observatory, Cambridge, Mass.). *Journal of the Atmospheric Sciences,* vol. 31, Jan. 1974, p. 287-303. 55 refs. NSF Grant No. GA-33990X.

Models for stratospheric temperature and ozone are developed and shown to give good agreement with observational data. The atmosphere is in local radiative equilibrium at heights above 35 km, and concentrations of ozone above 28 km can be satisfactorily estimated by models assuming photochemical equilibrium. Nitric oxide, formed by photochemical decomposition of nitrous oxide and ammonia, is an important catalyst for recombination of odd oxygen below 50 km, and is responsible for a reduction, by about a factor of two, in the computed column density of ozone. Possible consequences of nitric oxide and water vapor exhausted by stratospheric aircraft are discussed. It is argued that there should be a significant reduction in the concentration of stratospheric ozone, with a related decrease in stratospheric temperature, if the globally averaged aircraft source of nitric oxide exceeds twenty million molecules/sq cm/sec, approximately half the natural source of stratospheric nitric oxide. T.M.

**A74-20046** **An approximate method for the calculation of the pressure distribution on a wing-cone configuration.** A. Reggiori (Milano, Politecnico, Milan, Italy). *L'Aerotecnica - Missili e Spazio,* vol. 52, Oct. 1973, p. 340-345. 6 refs.

**A74-20049** # **The development and evaluation of weight-estimation formulas for aircraft design with the aid of methods of mathematical statistics and probability calculus (Die Entwicklung und Bewertung von Gewichtsabschätzungsformeln für den Flugzeugentwurf unter Zuhilfenahme von Methoden der mathematischen Statistik und Wahrscheinlichkeitsrechnung).** W. Schneider. Berlin, Technische Universität, Fachbereich Verkehrswesen, Dr.-Ing. Dissertation, 1973. 257 p. 77 refs. In German.

**A74-20069** # **Realization of the power amplification effect in a ramjet unit by applying the principle of boundary layer separation (Ob organizatsii effekta usileniia moshchnosti v struinom priamotochnom elemente na osnove printsipa otryva pogranichnogo sloia).** V. P. Lebedev, V. I. Miagkov, and G. A. Kopkov (Moskovskii Energeticheskii Institut, Moscow, USSR). *Mashinostroenie,* no. 12, 1973, p. 73-76. In Russian.

**A74-20076** **Conference on Decision and Control, 4th and Symposium on Adaptive Processes, 12th, San Diego, Calif., December 5-7, 1973, Proceedings.** Conference sponsored by the Institute of Electrical and Electronics Engineers. New York, Institute of Electrical and Electronics Engineers, Inc., 1973. 806 p. Members, $18.75; nonmembers, $25.

New concepts in decision making, control, and adaptation are described together with applications to current problems in such areas as energy, transportation, information, communication, economics, and urban-social systems. Specific topics include Kalman filtering techniques, information patterns and classes of stochastic control laws, computational methods for control problems, adaptive computer processing, observer algorithms, random variables in digital simulation, approximation methods in optimal control and mathematical programming, organizational systems, adaptive communications systems, decision algorithms in information theory, aircraft navigation and guidance, air traffic control, pattern recognition and interactive graphics, identification topics, and human decision making in automated control systems. T.M.

**A74-20095** * **Adaptive systems research in the NASA.** R. Montgomery (NASA, Langley Research Center, Hampton, Va.). In: Conference on Decision and Control, 4th and Symposium on Adaptive Processes, 12th, San Diego, Calif., December 5-7, 1973, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 378-388. 13 refs.

The past contributions of NASA to adaptive control technology are reviewed. The review places emphasis on aircraft applications although spacecraft and launch vehicle control applications are included. Particular emphasis is given to the adaptive control system used in the X-15 research aircraft. Problem areas that limited the realizable performance of this adaptive system are discussed. Current technological capabilities are used to extrapolate the present-day potential for adaptive flight control. Specifically, the potential created by use of the modern high-speed digital computer in flight control is discussed. Present plans for research in digital adaptive control systems for the NASA F8-C digital fly-by-wire program are presented. These plans are currently envisioned to include research in at least two types of adaptive controls, the system identification/on-line design type, and the model reference type. (Author)

**A74-20096** **Analysis of aided inertial navigation systems performance on international routes.** W. C. Hoffman (Aerospace Systems, Inc., Burlington, Mass.) and W. M. Hollister (MIT, Cambridge, Mass.). In: Conference on Decision and Control, 4th and Symposium on Adaptive Processes, 12th, San Diego, Calif., December 5-7, 1973, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 433-441. 12 refs. U.S. Department of Transportation Contract No. TSC-473.

The performance of hybrid navigation systems for commercial transoceanic flights is evaluated by means of a digital computer simulation. Error models are developed for aided-inertial navigation systems with external measurements from Doppler radar, Omega, and satellite-ranging. Key features of the simulation program AIRNAV (Aided-Inertial Reference NAVigation) are described. Covariance matrix error analysis is used to obtain the navigation error histories, with recursive navigation techniques to incorporate the measurements. A 34th-order error state vector is defined, which requires the numerical integration of up to 585 first-order differential equations to propagate the covariance matrix. Example computer results are presented for a typical North Atlantic flight. (Author)

**A74-20098** **Simplified navigation for unmanned aircraft.** R. W. Elsner and M. G. Currie (Lear Siegler, Inc., Santa Monica, Calif.). In: Conference on Decision and Control, 4th and Symposium on Adaptive Processes, 12th, San Diego, Calif., December 5-7, 1973, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 449-456. 5 refs.

This paper describes some design considerations of a navigation filter for an unmanned aircraft. Emphasis is on a simple, but accurate approach to navigation. Design considerations are discussed for the implementation of a fixed gain extended Kalman filter. Representative sensors including true airspeed, Doppler, and LORAN are described, and their integration into a modular navigation system is explained. (Author)

**A74-20099** **Realization of a horizontal collision avoidance system.** J. S. Karmarkar and A. W. Merz (Systems Control, Inc., Palo Alto, Calif.). In: Conference on Decision and Control, 4th and Symposium on Adaptive Processes, 12th, San Diego, Calif., December 5-7, 1973, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 457-461. 8 refs.

Horizontal aircraft collision avoidance maneuvers are examined,

along with the associated computer requirements. It is shown that analytical methods can be used to specify the turn maneuvers when the dynamic model of the relative motion includes both speeds and both maximum turn rates as arbitrary parameters. M.V.E.

**A74-20120 * Digital adaptive flight controller development.** H. Kaufman and P. Berry (Rensselaer Polytechnic Institute, Troy, N.Y.). In: Conference on Decision and Control, 4th and Symposium on Adaptive Processes, 12th, San Diego, Calif., December 5-7, 1973, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 780-783. 7 refs. Grant No. NGR-33-018-183.

The development of a digital adaptive flight control algorithm is described that combines a weighted least squares estimator with optimal linear regulator control logic designed to minimize a quadratic model following performance index. Very promising results for a typical fighter aircraft's trajectory over six distinct flight conditions are reported. M.V.E.

**A74-20125 Possible effects of a fleet of supersonic transports on the stratospheric ozone shield.** H. I. Schiff and J. C. McConnell (York University, Toronto, Canada). *Reviews of Geophysics and Space Physics*, vol. 11, Nov. 1973, p. 925-934. 32 refs.

The possibility that large quantities of water and various oxides of nitrogen /NO(x)/ can be injected into the stratosphere by a fleet of SSTs has raised concern over the possibility of a reduction in the ozone (O3) shield. Calculating such a reduction requires knowledge of the roles of NO(x) and H2O in the natural O3 budget. Recently, many of the rate constants required in a quantitative analysis have become known. These results incorporated into model calculations with natural sources of NO(x) and observed H2O mixing ratios tend to indicate that these constituents play an important role in the O3 budget in the natural stratosphere. At the same time, recent measurements of NO, NO2, and HNO3 have become available. The HNO3 measurements by several different groups appear to be mutually consistent. The results of both the NO measurements and the NO2 measurements, however, differ by an order of magnitude. Although the rate data available are not of sufficient accuracy to resolve the discrepancy between the measurements, it does appear that there will be a reduction in stratospheric O3 caused mainly by HO(x) or NO(x) catalysis or both. (Author)

**A74-20129 # A photo-electric position-following mechanism.** C. S. Indulkar (Indian Institute of Technology, New Delhi, India). *Institution of Engineers (India), Journal, Electronics and Telecommunication Engineering Division*, vol. 54, Sept. 1973, p. 5-7.

In many electromechanical systems, it is necessary that the movable arm of a variac, whose output voltage can be used for measurement or control purposes, is made to follow the rotation of a driving shaft in the system. For this purpose, a follower mechanism is necessary which would not impose any restraint on the driving shaft. One such follower mechanism has been discussed in this paper. The type of transducer used in the follower mechanism does not require a separate directional element when the driving shaft rotates in a reverse direction. (Author)

**A74-20166 # The airship can meet the energy challenge.** J. G. Vaeth (NOAA, National Environmental Satellite Service, Washington, D.C.). *Astronautics and Aeronautics*, vol. 12, Feb. 1974, p. 25-27.

It is suggested that lighter-than-air craft, in the form of very large airships, can be developed using nuclear propulsion. Such an airship can be designed to move cargo pieces weighing a million pounds and more into difficult-to-reach places at energy expenditures matching available resources. Inherent environmental cleanliness and quiet would be important fringe benefits. F.R.L.

**A74-20167 # Zeppelins - Not again.** W. P. Maiersperger. *Astronautics and Aeronautics*, vol. 12, Feb. 1974, p. 28-30.

Following a review of the performance of the 'Graf Zeppelin' over a period of years, aspects of zeppelin operation are discussed. Pressure height is basic to zeppelin operations. The zeppelin has proven itself a viable fair-weather mode of transportation, undoubtedly useful for certain social, scientific, and possibly military purposes. Technological recommendations would improve the safety record to a degree, but the dynamic conditions affecting structure and flight control must receive greater attention than they have in the past, and produce a revolutionary improvement over past performance records. F.R.L.

**A74-20208 Nitinol as a fastener material.** W. Schwenk and J. Huber (Grumman Aerospace Corp., Bethpage, N.Y.). *(Society for the Advancement of Material and Process Engineering, National Conference, 5th, Kiamesha Lake, N.Y., Oct. 9-11, 1973.) SAMPE, Quarterly*, vol. 5, Jan. 1974, p. 17-21.

The use of Nitinol for fastener applications is the principal area of discussion. Nitinol has the unique characteristic of undergoing a temperature-dependent phase transformation, which will cause significant changes in its configuration. These changes in shape offer the potential for developing fasteners which can expand radially for interference in a hole to improve structural fatigue, contract in length for clamping understructure, or form a rivet tail for blind fastening. The mechanical properties of the material, manufacturing techniques, and fastener design considerations are discussed. (Author)

**A74-20210 * Long range view of materials research for civil transport aircraft.** M. D. Ardema and M. H. Waters (NASA, Ames Research Center, Moffett Field, Calif.). *SAMPE, Quarterly*, vol. 5, Jan. 1974, p. 28-38. 26 refs.

The impact of various material technology advancements on the economics of civil transport aircraft is investigated. Benefits of advances in both airframe and engine materials are considered. Benefits are measured primarily by improvements in return on investment for an operator. Materials research and development programs which lead to the greatest benefits are assessed with regards to cost, risk, and commonality with other programs. Emphasis of the paper is on advanced technology subsonic/transonic transports (ATT type aircraft) since these are likely to be the next generation of commercial transports. (Author)

**A74-20213 Clean, bright, and dry.** J. C. Bradley (Gulf Research and Development Co., Pittsburgh, Pa.). In: Manual on requirements, handling, and quality control of gas turbine fuel. Philadelphia, Pa., American Society for Testing and Materials, 1973, p. 57-72.

It is the purpose of this paper to pinpoint some of the sources and types of fuel contamination and to outline precautions and procedures currently in use by the industry to preclude the possibility of contaminated fuel from reaching the turbine. In this connection, practices used in the aviation sector of the industry will be explored in detail since millions of gallons of jet fuel daily are being supplied to aviation turbines clean, bright, and dry with utmost reliability of product quality. Similar procedures applied to ground and marine units can assure dependable and economical operation. (Author)

**A74-20217** **Survey of trace metals in distillate fuels.** C. C. Ward (U.S. Bureau of Mines, Bartlesville Energy Research Center, Bartlesville, Okla.). In: Manual on requirements, handling, and quality control of gas turbine fuel. Philadelphia, Pa., American Society for Testing and Materials, 1973, p. 133-138; Discussion, p. 139-142.

Published information on the levels of trace metals in distillate fuels is scarce, so members of Section D02.E on Burner, Diesel, and Gas Turbine Fuel Oils of ASTM Committee D-2 on Petroleum Products and Lubricants agreed to pool information available in individual laboratories. Twelve laboratories furnished data on 408 samples of kerosines, diesel fuels, burner fuels, aviation turbine fuels, and gas turbine fuels. Data on trace metals content included that of sodium, potassium, vanadium, calcium, lead, magnesium, and copper. This survey to pool information available on the amounts of trace metals in random samples of distillate fuels does not lend itself to statistical treatment of the data. However, it does show that the level of trace metals in currently produced distillate fuels is much lower than the amounts presently allowed in ASTM Specification for Gas Turbine Oils (D 2880-71). (Author)

**A74-20274** **Art of the Stretch 8. I.** C. Ramsey. *Shell Aviation News*, no. 419, 1973, p. 18-22.

A summary of extensive professional experiences with the DC-8-63 is given, covering the flight instrument systems, takeoff performance, and minimum control speed of the aircraft. Aircraft operation in adverse conditions, and the taxiing and takeoff procedures are discussed with particular attention to icing conditions. V.Z.

**A74-20275** **VITAL II.** L. Luce (Pacific Southwest Airlines, San Diego, Calif.). *Shell Aviation News*, no. 419, 1973, p. 26-29.

Discussion of Virtual Image Take-off and Landing (VITAL II) system which is operational on a Pacific Southwest Airlines Boeing 727 flight simulator in San Diego. The system is characterized as a revolutionary low-cost low-maintenance visual system which is superior to other simulators in providing a greater simulated training potential for pilots. Basic in the operation of this system is the capability of the simulator computer to transfer aircraft attitude and position data to its visual computer. The flexibility and versatility of the system are discussed. V.Z.

**A74-20280** * # **Subsonic potential aerodynamics for complex configurations - A general theory.** L. Morino (Boston University, Boston, Mass.) and C.-C. Kuo (NASA, Ames Research Center, Moffett Field, Calif.). *AIAA Journal*, vol. 12, Feb. 1974, p. 191-197. 33 refs. Grant No. NGR-22-004-030.

A general theory of subsonic potential aerodynamic flow around a lifting body having arbitrary shape and motion is presented. By using the Green function method, an integral representation for the velocity potential is obtained for both supersonic and subsonic flow. Under the small perturbation assumption, the potential at any point in the field depends only upon the values of the potential and its normal derivative on the surface of the body. On the surface of the body, this representation reduces to an integro-differential equation relating the potential and its normal derivative (which is known from the boundary conditions) on the surface. The theory is applied to finite-thickness wings in subsonic steady and oscillatory flows. (Author)

**A74-20281** # **Noise characteristics of a turbulent crosswind jet.** J. E. Cole, III (Tufts University, Medford, Mass.). *AIAA Journal*, vol. 12, Feb. 1974, p. 198-202. 11 refs.

The turbulent flow which results when a circular jet issues into a crosswind is a noise source which is encountered during take-off and landing of certain types of V/STOL aircraft. The acoustic intensity of the noise from this flow is calculated by extending the free jet model of Ribner to those crosswind jets for which the ratio of jet velocity to crosswind velocity is between 6 and 10. The extended model accounts for the noncircular cross section, the shortened potential core region, and the flow characteristics in the initial mixing region of the crosswind jet. The result of this analysis is an expression for the directivity function of the acoustic intensity from a crosswind jet of a V/STOL aircraft in flight. The maximum acoustic intensity is calculated to be in a direction which is slightly forward of the sidelines direction. (Author)

**A74-20293** * # **Attachment-line flow on an infinite swept wing.** T. Cebeci (Douglas Aircraft Co., Long Beach, Calif.). *AIAA Journal*, vol. 12, Feb. 1974, p. 242-245. 7 refs. Contract No. NAS1-11623.

A proposed method for calculating three-dimensional incompressible laminar and turbulent boundary layers is investigated with respect to its applicability to incompressible attachment line flow on an infinite swept wing. The calculation results obtained exhibit satisfactory agreement with experimental data. M.V.E.

**A74-20298** # **Compressibility effects in unsteady thin-airfoil theory.** R. K. Amiet (United Aircraft Research Laboratories, East Hartford, Conn.). *AIAA Journal*, vol. 12, Feb. 1974, p. 252-255. 9 refs. Research supported by the United Aircraft Corp.

Based on a previous solution of Miles (1950), an analytical expression is derived for the pressure, lift, and moment on a two-dimensional airfoil encountering a sinusoidal gust in compressible subsonic flow. The obtained solution appears to be a significant improvement over Osborne's (1973) analytical approximation and the original result of Miles (1950). M.V.E.

**A74-20311** **Selection of the economically optimal blade profile for axial fluid flow engines (Auswahl des wirtschaftlich optimalen Schaufelprofils für axiale Strömungsmaschinen).** A. Teufelberger. *(Verein Deutscher Ingenieure, Tagung über strömungstechnische Probleme bei der Entwicklung von Strömungsmaschinen, Braunschweig, West Germany, Mar. 14-16, 1973.) VDI-Berichte*, no. 193, 1973, p. 105-115. 5 refs. In German.

The efficiency and the price of a multistage, axial fluid flow engine depends significantly on the characteristics of the blade profile. In the selection of the blade profile for a steam engine, the blade dimensions must be chosen on the basis of the flow volume and the admissible stress data for the blade material. Questions concerning the relation between the mechanical and the aerodynamic characteristics are discussed. The general principles of the approach described are applied to a specific problem involving the high-pressure section of a steam turbine. G.R.

**A74-20313** **Aerodynamic problems of turbojet propulsion systems, repercussions on gas turbine development (Strömungstechnische Probleme der Turbostrahlantriebe, Rückwirkung auf die Gasturbinenentwicklung).** H. G. Münzberg. *(Verein Deutscher Ingenieure, Tagung über strömungstechnische Probleme bei der Entwicklung von Strömungsmaschinen, Braunschweig, West Germany, Mar. 14-16, 1973.) VDI-Berichte*, no. 193, 1973, p. 139-147. 5 refs. In German.

Questions regarding the design of the entire propulsion system are considered, giving attention to the combustion temperature and gas turbine efficiency. Various types of supersonic compressors are discussed together with a high-pressure turbine, developments concerning the reduction of engine noise, and conditions in the case of

very high flight velocities. It is pointed out that the improvement of gasdynamic conversion characteristics has a much greater effect on thrust enhancement than the improvement of the characteristics of all other components. G.R.

**A74-20325 The state of development of axial pumps with supercavitating cascades (Entwicklungsstand der Axialpumpen mit vollkavitierender Beschaufelung /Superkavitation/).** J. Voigt. *(Verein Deutscher Ingenieure, Tagung über strömungstechnische Probleme bei der Ertwicklung von Strömungsmaschinen, Braunschweig, West Germany, Mar. 14-16, 1973.) VDI-Berichte,* no. 193, 1973, p. 267-271. 7 refs. In German.

Questions of the economical employment of supercavitating pumps are considered together with details concerning the determination of a wing profile in the case of supercavitation. Theoretical relations regarding supercavitation in the case of a single wing cannot be satisfactorily applied to the cascade of an axial pump. Linearized cascade theories are employed for obtaining estimates concerning the relations between cavitation number and operational parameters. An approach reported by Hsu (1969) for the derivation of such estimates is considered. G.R.

**A74-20422 Safety during automatic landing with poor visibility (La sécurité en atterrissage automatique en mauvaise visibilité).** J.-P. de Beauchene (Délégation Ministérielle pour l'Armement, Paris, France). *(Instituts de Navigation Européens et Américains, Congrès International, Hanover, West Germany, Oct. 2-5, 1973.) Navigation* (Paris), vol. 22, Jan. 1974, p. 31-46. In French.

Review of the operational and safety objectives which must be attained by an automatic all-weather landing system, including some examples of such systems under study or actually realized. After briefly reviewing certain principles of flight mechanics and automatic piloting and also briefly describing the ILS system used to define the approach trajectory, the various categories of all-weather landing are cited, as well as the possible procedures that can be followed in the event of automatic pilot failure. A number of recently developed automatic all-weather landing systems are described, including the Sud-Lear system mounted on the Caravelles of Air-Inter, a monitored system used on the Dassault-Mercure aircraft to be flown by Air-Inter, the double monitored system employed on the Concorde, and a quadruple system to be used on the Airbus A 300 B. A.B.K.

**A74-20478 A fatigue failure criterion for fiber reinforced materials.** Z. Hashin and A. Rotem (Technion - Israel Institute of Technology, Haifa, Israel). *Journal of Composite Materials,* vol. 7, Oct. 1973, p. 448-464. 7 refs. Contract No. F44620-71-C-0100.

A simple fatigue failure criterion for unidirectionally fiber reinforced laminae under oscillatory states of combined plane stress has been established. The criterion is expressed in terms of three S-N curves which are easily obtained from fatigue testing of off-axis unidirectional specimens under uniaxial oscillatory load. An extensive series of tests have demonstrated good agreement of the failure criterion with experimental data. (Author)

**A74-20498 Failure of helicopter turbines due to the employment of a steel in a corrodible condition in combination with a design unsuited for the material (Zerstörung von Hubschrauberturbinen durch Einsatz eines Stahles in korrosionsanfälligem Zustand bei gleichzeitig nicht werkstoffgerechter Konstruktion).** G. Lange (Braunschweig, Technische Universität, Braunschweig, West Germany). *Zeitschrift für Werkstofftechnik,* vol. 5, Jan. 1974, p. 9-13. In German.

**A74-20522 # Explanations and remarks on standards for flight mechanics (Vysvetleni a poznamky k normam pro mechaniku letu).** K. Jansa. *Zpravodaj VZLU,* no. 4, 1973, p. 17-22. In Czech.

Brief review of the history and manner of preparation of the International Standards for Flight Mechanics within the framework of the International Standard Organization. The main points of Rebuffet's comments on the results thus far obtained by Subcommission SC 3 of this organization, which develops these standards, are summarized. Finally, a brief review is given of the contribution of Czechoslovakia to the work of this subcommission. A.B.K.

**A74-20523 # Technology of production of sandwich panels with aluminum honeycomb cores (Technologie vyroby sendvicu s hlinikovym vostinovym jadrem).** Z. Smojkal. *Zpravodaj VZLU,* no. 4, 1973, p. 23-31. In Czech.

Review of the various methods of bonding used in the production of sandwich panels with aluminum honeycomb cores. These methods, which include bonding on a vacuum table, bonding by pressing using a male die and a female die, bonding in a curing oven using a pressing tool, bonding in individual heated pressing tools, and bonding in an autoclave, are described and evaluated from various standpoints, for example, the applicability of various adhesives, suitability for series production, economy, etc. A brief description is given of the bonding tools, and the technological procedure for bonding sandwich panels is indicated. Special attention is paid to the method of production of sandwich panels with aluminum honeycomb cores and laminated skins. A.B.K.

**A74-20524 # Requirements on the purity of aircraft fuels (Pozadavky na cistotu leteckych paliv).** J. Krotky. *Zpravodaj VZLU,* no. 4, 1973, p. 33-38. In Czech.

Review of the problems connected with ensuring and monitoring the purity of aircraft fuels, particularly fuels for jet engines. Particular attention is paid to impurities which do not arise as a result of chemical changes but enter the fuel from the environment on its way from the factory to the consumer. The effects of mechanical impurities, water, microorganisms, and surface-active materials on aircraft fuels are cited, and methods of preventing these impurities from getting into the fuels are indicated. A.B.K.

**A74-20548 Various mechanisms applied to the Concorde main landing gear (De divers mécanismes appliqués au train principal de 'Concorde').** P. Lallemant (SNECMA, Division Hispano-Suiza, Bois-Colombes, Hauts-de-Seine, France). *Revue Française de Mécanique,* 1st Quarter, 1973, p. 29-32. In French.

Description of the design and operation of the systems comprising the Concorde main landing gear. The retraction system employed is of articulated crank shaft/connecting rod type and rests on the caisson at a point which is eccentric with respect to the pivoting axis of the landing gear during the retraction. The locking system employed features an internally locking telescopic strut which combines in a single mechanism the maneuver drive element and the element resisting the landing stresses. The mechanism initiating retraction is located to one side of the landing gear and includes a jack, a pendulum-type connecting rod, and a guide bar arranged in such a way as to ensure optimal efficiency. The mechanism developed for the delicate machining of the bulb located in the upper part of the landing gear shaft is also described. A.B.K.

**A74-20595 Display systems - An airborne look ahead.** Mr. Braid (Ferranti, Ltd., Edinburgh, Scotland). *Optical Spectra,* vol. 8, Feb. 1974, p. 35, 36.

Description of the types of airborne optical display systems designed for use on modern military aircraft. Details are given on a

head-up display, a head-down display, and a helmet-mounted display. Considerable progress is noted in the development of airborne information displays combining optics and electronics in the conversion of invisible signals to visible signals. V.Z.

**A74-20624** **Urban air traffic and city planning: Case study of Los Angeles County.** M. C. Branch (Southern California, University, Los Angeles, Calif.). New York, Praeger Publishers, 1973. 117 p. 200 refs. $15.

It is pointed out that city planning as it has been practiced in the United States for the past half century can no longer cope with forthcoming urban air travel, which already has caused serious disruption and damage to the larger cities. Much more effective institutions for planning cities and metropolitan regions must be established. A number of recommendations for improving the air traffic situation in metropolitan areas are proposed. V.P.

**A74-20662** **Winter Simulation Conference, Washington, D.C., January 14-16, 1974, Proceedings. Volume 2.** Conference sponsored by AIIE, ACM, IEEE, ORSA, S.H.A.R.E., SIGSIM, SCS, and TIMS. Edited by H. J. Highland. Elmont, N.Y., Association for Computing Machinery, Inc., 1974. 397 p. Price of two volumes, $25.

Aspects of mission performance simulation are discussed together with an application of parametric time series in simulation modeling, an aquatic simulation with threshold conditions, and a mathematical formulation of discrete event systems. Other subjects considered include experiments in simulating OS/360 from performance data, market strategy via simulation, the validation of computer simulation models using parametric time series analysis, the simulation of passenger movements through a transit station, and a probabilistic evaluation of fallout effects associated with nuclear air bursts. Ratio estimates in Monte Carlo simulations are investigated along with the simulation of air traffic, a statistical response surface generator design, and a stimulus-driven model of concept identification.

G.R.

**A74-20663** **Air traffic control scheme through simulation.** J. C. Yu (Virginia Polytechnic Institute and State University, Blacksburg, Va.) and S. A. Akhand (Stockton State College, Pomona, N.J.). In: Winter Simulation Conference, Washington, D.C., January 14-16, 1974, Proceedings. Volume 2. Elmont, N.Y., Association for Computing Machinery, Inc., 1974, p. 551-557. 12 refs. NSF Grant No. GK-30325.

A description is given of a large-scale simulation model of an airport terminal area. The model can be used for the analysis of the stochastic air traffic control problem. The complex interactions among the various components of the ATC system are taken into account by the model. The system approach used makes it possible to determine also the overall effect of ATC performance as a consequence of any proposed change. The simulation model has been subjected to a number of tests for complete validation. The test results indicate that the discrete event modeling of system effects can adequately simulate air-terminal operations. G.R.

**A74-20754** # **SAAB digital flight control.** M. A. Mathews, Jr. (Honeywell, Inc., Government and Aeronautical Products Div., Minneapolis, Minn.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 12th, Washington, D.C., Jan. 30-Feb. 1, 1974, Paper 74-26.* 17 p. Members, $1.50; nonmembers, $2.00.

Description of the development and verification testing of a digital automatic flight control system (AFCS) for the SAAB AJ-37 (Viggen) aircraft. The development of the digital system evolved from the analog system originally designed and developed for the AJ-37 aircraft. The digital system, developed specifically for this test demonstration, consists of the digital mechanization of one of the two analog channels in the original command augmentation system. The pilot can select either the digital channel, the analog channel, or both. The objective of this program was to establish with a degree of confidence approaching certainty that a digital AFCS can provide performance equivalent to an analog AFCS. This objective was achieved with a high degree of success as demonstrated by the results of the flight test program. (Author)

**A74-20755** * # **A digital fly-by-wire technology development program using an F-8C test aircraft.** C. R. Jarvis (NASA, Flight Research Center, Edwards, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 12th, Washington, D.C., Jan. 30-Feb. 1, 1974, Paper 74-28.* 11 p. 8 refs. Members, $1.50; nonmembers, $2.00.

A digital fly-by-wire flight control system has been installed in an F-8C test airplane and has undergone extensive ground and flight testing as part of an overall program to develop digital fly-by-wire technology. This is the first airplane to fly with a digital fly-by-wire system as its primary means of control and with no mechanical reversion capability. Forty-two test flights were made for a total flight time of 57 hours. Six pilots participated in the evaluation. This paper presents an overview of the digital fly-by-wire program and discusses some of the flight-test results. (Author)

**A74-20760** # **Reduction of noise from small turbopropulsion engines.** P. A. Shahady, C. A. Lyon (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio), R. N. Tedrick, and R. W. Heldenbrand (AiResearch Manufacturing Company of Arizona, Phoenix, Ariz.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 12th, Washington, D.C., Jan. 30-Feb. 1, 1974, Paper 74-59.* 18 p. 20 refs. Members, $1.50; nonmembers, $2.00. Contract No. F33615-71-C-1457.

Summary of an exploratory research effort to develop the technology base necessary to effectively reduce the noise signature of existing small turboprop and turbofan engines to acceptable levels for low-altitude reconnaissance/surveillance and special operations missions. Emphasis was placed on the application of sound attenuation techniques rather than on internal engine design changes. The principal results of the program were the development of (1) a comprehensive bank of small-engine/component-noise data relatively free of extraneous noise sources, (2) simple and accurate small-engine/component-noise prediction methods for use in propulsion system design tradeoff studies, (3) simplified analysis techniques to design small-engine noise suppression hardware and to predict the attenuation for typical installations, and (4) preliminary design methods to assess engine performance and weight penalties associated with typical suppression techniques. (Author)

**A74-20774** # **Unsteady viscous flow on oscillating airfoils.** W. J. McCroskey (U.S. Army, Air Mobility Research and Development Laboratory, Moffett Field, Calif.) and J. J. Philippe (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 12th, Washington, D.C., Jan. 30-Feb. 1, 1974, Paper 74-182.* 12 p. 31 refs. Members, $1.50; nonmembers, $2.00.

Incompressible laminar and turbulent flows over flat plates and airfoils have been investigated numerically and experimentally in unsteady flow conditions. Important differences were found between laminar and turbulent flat plate flows over a wide range of oscillation frequencies. Also, the importance of unsteady effects on laminar boundary layers was found to diminish rapidly with increasing

longitudinal pressure gradients, whereas turbulent separation on airfoils was significantly affected by oscillatory motion when the incidence approached the stall angle. The calculated hysteresis in turbulent separation followed well-known trends of dynamic stall delay, but the results failed to indicate some of the important features of dynamic stall that were observed. (Author)

A74-20775 * # **Effect of configuration variation on externally blown flap noise.** R. G. Dorsch, J. H. Goodykoontz, and N. B. Sargent (NASA, Lewis Research Center, V/STOL and Noise Div., Cleveland, Ohio). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 12th, Washington, D.C., Jan. 30-Feb. 1, 1974, Paper 74-190.* 33 p. 26 refs. Members, $1.50; nonmembers, $2.00.

The sensitivity of flap interaction noise to variations in engine-under-the-wing externally blown flap geometry was investigated with a large cold-flow model. Both two- and three-flap wing sections (7-ft chord) with trailing flap angles up to 60 deg were employed. Exhaust nozzles included coaxial, plug, and 8- and 13-in.-diam conical configurations. These nozzles were tested at two positions below the wing (19-1/4 and 29-1/4 in.). The effects of these geometry variations on noise level, directivity, and spectral shape are summarized in terms of exhaust flow parameters evaluated at the nozzle exit and at the flap impingement station. The results are also compared with limited flap noise data available from tests using real engines. (Author)

A74-20825 **Engine condition monitoring - The Alitalia approach.** E. Eula and G. Capodagli (Compagnia Nazionale Alitalia, Rome, Italy). *Shell Aviation News,* no. 420, 1973, p. 24-29.

Manual recording by flight crews of a limited number of engine parameters from standard flight deck instrumentation, and automatic recording by Airborne Integrated Data System of certain number of system and engine parameters are described as the two methods adopted by Alitalia for collecting information on the behavior of aircraft engines. The qualities of both methods are evaluated and experiences with them to date are discussed. Flight Data Entry Panel, Flight Data Acquisition Unit, Performance/Maintenance Recorder, and Digital Flight Data Recorder are indicated as ingredient of hardware configurations in the continuing development of engine condition monitoring at Alitalia. V.Z.

A74-20834 # **Advanced composites.** A. M. Lovelace (USAF, Systems Command, Andrews AFB, Md.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 10th, Washington, D.C., Jan. 28-30, 1974, Paper 74-242.* 12 p. 12 refs. Members, $1.50; nonmembers, $2.00.

Numerous examples of composites exist in nature. For the case of filamentary composites, an example can be found in bamboo. Composites were used for aerospace vehicles since their birth. The Mosquito aircraft represents a milestone in the development of an all-composite aircraft. The application of glass fiber-polyester composites to Air Force vehicles was made in numerous cases during and shortly after World War II. Modern aerospace applications of glass fiber include the fabrication of the Polaris missile casing through filament winding. An important factor for a further broadening of the use of plastics is an increase in the strength of the composites. The theory of composites is considered along with present technological developments and future possibilities for the employment of composites. G.R.

A74-20836 # **Aircraft life cycle profitability - The manufacturer's challenge.** R. E. Brown and J. J. Italiane (Boeing Commercial Airplane Co., Seattle, Wash.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 10th, Washington, D.C., Jan. 28-30, 1974, Paper 74-280.* 15 p. Members, $1.50; nonmembers, $2.00.

The ways in which the aircraft manufacturer influences the profitability of the airplane during the life cycle is shown, starting with the design and construction phases, and terminating with the aircraft's useful life. It is shown that the manufacturer influences all the investment cost, somewhat less than half the airplane operating cost, a small part of traffic costs, and most of the useful life parameter. He also has a substantial influence on the earning capability. V.P.

A74-20837 # **Aircraft life cycle profitability - The operator's challenge.** J. G. Borger and L. H. Allen (Pan American World Airways, Inc., New York, N.Y.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 10th, Washington, D.C., Jan. 28-30, 1974, Paper 74-281.* 9 p. Members, $1.50; nonmembers, $2.00.

Two fundamental areas in which the operator can influence aircraft life cycle profitability are examined. The first area includes aircraft design goals, route performance, investment cost, operating costs, growth prospects, passenger appeal, technical specifications, and maintenance requirements. The second area includes operating goals, service quality, revenue production, aircraft life, utilization, and reliability. The fundamentals of good aircraft design are outlined, and the importance that manufacturer and operator adhere to these fundamentals is emphasized. V.P.

A74-20900 # **Correlational ground speed meters and drift indicators of flight vehicles (Korreliatsionnye izmeriteli putevoi skorosti i ugla snosa letatel'nykh apparatov).** M. K. Borkus and A. E. Chernyi. Moscow, Izdatel'stvo Sovetskoe Radio, 1973. 169 p. 44 refs. In Russian.

A procedure is developed for flight-vehicle ground speed and drift measurements by determining the correlation characteristics of radio signals reflected from the ground and received by diversity antennas positioned along the axis of the flight vehicle antenna. Theoretical basis of this technique is set forth and the designs of suitable ground speed meters and drift indicators are discussed. The functional characteristics of these instruments and their errors are evaluated. Practical applications of different types of these instruments are considered. V.Z.

A74-20904 # **Noise suppressing devices (Shumoglushashchie ustroistva).** A. S. Pogodin. Moscow, Izdatel'stvo Mashinostroenie, 1973. 176 p. 14 refs. In Russian.

Numerous problems associated with noise suppression in industrial plants, aircraft plants, engine test stands, at airports, etc. are discussed. Vibration damping materials, soundproofing materials, and acoustic screens are examined, along with methods of suppressing noise in metal working and assembly shops, aircraft noise, and noise produced by compressors, turbocompressors, and stationary gas turbines. V.P.

A74-20905 # **Reliability of aircraft navigation computers (Nadezhnost' samoletnykh navigatsionno-vychislitel'nykh ustroistv).** Ts. N. Lipchin and L. Ts. Lipchin. Moscow, Izdatel'stvo Mashinostroenie, 1973. 196 p. 57 refs. In Russian.

Some basic problems involved in improving the reliability of on-board complexes of navigation instruments and the reliability of navigation computers are examined, and a procedure for determining these reliabilities is developed. Particular attention is given to the current trends of improving the reliability of navigation computers both during their serial production and service life, and to engineering methods of determining the reliability of complex systems. Approaches to the solution of optimal reliability problems are examined. V.P.

**A74-20919** # **Reliability of adaptive systems (Nadezhnost' adaptivnykh sistem).** G. K. Moskatov. Moscow, Izdatel'stvo Sovetskoe Radio, 1973. 104 p. 87 refs. In Russian.

Methods of evaluating the reliability of adaptive flight control systems are examined. The stabilization and control of flight vehicles are discussed from the standpoint of the theory of queues, as a process of servicing 'impatient customers.' The ability of adaptive systems to compensate for various parametric and structural infractions is demonstrated. The theory of semi-Markov processes is used to construct a mathematical reliability model for adaptive feedback control systems, with allowance for a random time required for adaptation. The failure-proof characteristics of a hypothetical adaptive automaton are calculated on a computer. V.P.

**A74-20938** **Reliability and choosing number of prototypes.** A. S. Pollack and R. A. Nulk (U.S. Army, Office of the Chief of Research and Development, Washington, D.C.). In: Annual Reliability and Maintainability Symposium, Los Angeles, Calif., January 29-31, 1974, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 84-90. 5 refs.

The application of a reliability growth model to a helicopter development program is discussed. Various options are considered with respect to the number of prototypes to be procured for each phase of the development. For each option the amount of calendar time to be consumed by the test program is determined. The information is used to estimate the effect of each option upon the R and D costs. The analysis indicates that it would be prudent to plan a program which provides for six prototypes that can be used for flight testing by each contractor. The appropriate distribution of the test resources between reliability growth and reliability demonstration testing is also considered. G.R.

**A74-20944** **Some experiences from the use of an LCC approach.** H. Ebenfelt (Systecon AB, Stockholm, Sweden) and S. Ogren (Swedish Air Materiel Administration, Stockholm, Sweden). In: Annual Reliability and Maintainability Symposium, Los Angeles, Calif., January 29-31, 1974, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 142-146.

The LCC approach discussed in this paper has been developed to suit a specific need, determined by factors such as the competitive situation, the time horizon and associated risks, program and contract characteristics. These factors and their implications on techniques and procedures used during different phases of system acquisition are reviewed. A brief description of the approach is included as it applies to conceptual studies, source selection and contracting. The experience thus gained is finally summed up in statements pointing at present problem areas but also indicating advantages. (Author)

**A74-20945** **Plan for developing structural criteria for composite airframes.** S. D. Manning and G. H. Lemon (General Dynamics Corp., Convair Aerospace Div., Fort Worth, Tex.). In: Annual Reliability and Maintainability Symposium, Los Angeles, Calif., January 29-31, 1974, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 155-162. 18 refs. Contract No. F33615-72-C-1066. AF Project 4364.

A plan is presented for developing structural criteria specifically for advanced composite airframes. This plan complements the new MIL-STD-1530 specification. Details of the proposed plan and critical issues are discussed in terms of MIL-STD-1530 requirements. Implementation of the proposed plan and problem areas are discussed. (Author)

**A74-20950** **Reliability demonstration testing using failure-free trials.** H. S. Hammer (Rockwell International Corp., Autonetics Div., Anaheim, Calif.). In: Annual Reliability and Maintainability Symposium, Los Angeles, Calif., January 29-31, 1974, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 201-205.

It is suggested that reliability demonstration testing be conducted in terms of a failure-free test period conducted at the conclusion of, or as an integral part of burn-in, on each deliverable equipment. Compliance with reliability requirements is established by specifying a maximum number of allowable trials (attempts to complete the failure-free test period) in a consecutively produced lot or quantity of systems. This suggested failure-free reliability demonstration test method has the advantage of assuring that each equipment receives a minimum burn-in, while providing added confidence because reliability determinations are based on test data from all equipments produced and not just a small sample. A real-time test reject or accept decision can also be made directly by the on-site personnel. This is because these decisions are based on the quantity of successful and unsuccessful failure-free trials and not on relevant failure determinations. (Author)

**A74-20952** **Simulation of dispatch reliability for a fleet of large commercial aircraft.** M. O. Locks (Oklahoma State University, Stillwater, Okla.) and G. L. Pauler (Los Angeles, Loyola University, Los Angeles, Calif.). In: Annual Reliability and Maintainability Symposium, Los Angeles, Calif., January 29-31, 1974, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 226-228.

For a fleet of large commercial aircraft, management's objectives include attaining a prespecified dispatch reliability (DR), a measure of the radio of departures within a stated time of scheduled departure to total departures. Data from the first 18 months of revenue operation are used to assess and predict DR for future periods. Goodness-of-fit analysis shows the delay times for departures delayed six minutes or more tend to fit lognormal distributions. The estimated distributions were used to assess DR both for historical data and future periods by simulation. The results show that the delay time is too large to meet management's objectives. (Author)

**A74-20954** **Equipment procured reliability and real-life survival.** O. Markowitz (U.S. Navy, Aviation Supply Office, Philadelphia, Pa.). In: Annual Reliability and Maintainability Symposium, Los Angeles, Calif., January 29-31, 1974, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 249-255. 6 refs.

Recommendations are made for improving communications between suppliers and users of equipment in the area of reliability. It is concluded that the hazards in real life equipment flow and end use do not compare to those inherent in equipment laboratory verification of failure rate. Thus any translation of laboratory or specified failure rate as a direct expectation of end use failure rate is inadequate. There is much needed in the way of the operator's understanding of what is required from contractors in the context of reliability and, as well, much is needed in contractor's understanding of the real life equipment flow and hazards of survival. T.M.

**A74-20967** **Hazard function monitoring of airline components.** M. L. Shooman (New York, Polytechnic Institute, Brooklyn, N.Y.) and S. Tenenbaum (Aero Data, Inc., Syosset, N.Y.). In: Annual Reliability and Maintainability Symposium, Los Angeles, Calif., January 29-31, 1974, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 383-390.

As part of their reliability programs, all of the major U.S.

airlines systematically collect component failure data. These data are analyzed in various ways and to varying degrees. One of the important methods is hazard function analysis which is done by computer for dozens to hundreds of components. This paper discusses a hazard function monitoring system which was designed to aid the reliability engineer by providing automated smoothing and plotting of results and a capability for computer recognition of problem components and exception reporting. The mathematical pattern recognition techniques used in this hazard monitoring system provide parameters which accurately characterize a wide range of hazard data. These parameters describe a more flexible hazard model than that conventionally used in large reliability data collection systems (e.g., FARADA, GIDEP), yet can still be compactly solved and easily interpreted. T.M.

**A74-20969** **DC-10 avionics parts reliability in review.** R. S. Babin (Douglas Aircraft Co., Long Beach, Calif.). In: Annual Reliability and Maintainability Symposium, Los Angeles, Calif., January 29-31, 1974, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 403-408.

The McDonnell Douglas DC-10 aircraft program has demonstrated the effectiveness of a number of reliability and quality engineering controls and disciplines. Notable among them are several key controls on electrical, electronic, and electromagnetic parts in the avionics systems. A qualitative review of those parts controls is presented, utilizing DC-10 case histories (actual part-failure problems) as a basis for discussion and evaluation of the relative effectiveness of the controls. The controls that have shown most room for improvement, judged by the impact of their deficiencies on fielded equipment reliability, are: (1) part-failure reporting, analysis, and corrective action, (2) multiple-source part procurement, and (3) the designation and control of microcircuit part quality. (Author)

**A74-20974** **Flight test safety analysis of the all weather landing system /AWLS/ program.** L. S. Gephart (Dayton, University, Dayton, Ohio) and R. H. Keegan (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). In: Annual Reliability and Maintainability Symposium, Los Angeles, Calif., January 29-31, 1974, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 436-442. FAA-USAF-supported research.

The ultimate objective of this joint FAA-USAF program is to obtain Category III approach and landing experience in actual weather with a large turbojet aircraft. This effort entails testing and evaluating all elements of the Category III air-ground instrument landing system within a well rehearsed and controlled environment. This paper details the total equipment system and its configuration for both primary and back up operational/experimental modes. Advanced displays employing new concepts and design features are part of the augmented aircraft configuration. Hardware reliability, maintenance, and planned equipment performance monitoring procedures are analyzed in conjunction with specified flight test operational procedures to establish base line performance and overall system safety. The analysis includes real time validation procedures and associated transitional modes to compensate for both hardware failures and electromagnetic environmental interference conditions. (Author)

**A74-20987** **Risk analysis - A program management tool.** J. D. Gault (Boeing Co., Wichita, Kan.). In: Annual Reliability and Maintainability Symposium, Los Angeles, Calif., January 29-31, 1974, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1974, p. 548-551.

Investigation of the adaptability of risk analysis methodology to evolutionary situations such as environmental problems. Techniques presently used to evaluate airplane fatigue risks are shown to be applicable to any situation having an inherent risk which increases with time but may be countered by periodic application of corrective measures. Control of our environment, mass transportation, and consumer protection are among the problems that fall into this category. The investigation results indicate that risk analysis provides an approximate answer to the right problem by tying together the interrelated influences in a complex system. M.V.E.

**A74-21104** **The high subsonic flow around a two-dimensional aerofoil with a trailing edge control surface.** D. Nixon (Queen Mary College, London, England). *Aeronautical Quarterly*, vol. 24, Nov. 1973, p. 273-283. 5 refs.

The effect of the operation of a 15% trailing edge control surface on the flow around a two-dimensional airfoil in a high subsonic shock-free condition is investigated, using the integral equation method developed by Nixon and Hancock (1972). The effect of retaining the nonlinearities in the transonic potential equation is to increase considerably the magnitude of the pressures over the front part of the airfoil in comparison with the pressure found using a modified linearized theory in which significant second-order terms in the boundary conditions are retained. The magnitude of the lift coefficient and the pitching moment coefficient are increased by 10 to 15% over the values found using the modified linear theory, and by 20% over the values found using standard linear theory. However, the magnitude of the hinge-moment coefficient is decreased by the order of 20% compared with the modified linear values and by 30% when compared to the standard linear values. (Author)

**A74-21105** **The influence of non-linear longitudinal aerodynamic characteristics on the power spectral response of aircraft to atmospheric turbulence.** P. A. T. Christopher (Cranfield Institute of Technology, Cranfield, Beds., England) and J. M. H. Dunn (Delaney Gallay, Ltd., London, England). *Aeronautical Quarterly*, vol. 24, Nov. 1973, p. 284-294. 8 refs.

**A74-21290** # **Conceptual options for future aircraft-ship operations.** J. J. Mulquin (U.S. Naval Air Systems Command, Washington, D.C.). *American Institute of Aeronautics and Astronautics and Society of Naval Architects and Marine Engineers, Advanced Marine Vehicles Conference, San Diego, Calif., Feb. 25-27, 1974, AIAA Paper 74-300.* 11 p. 32 refs. Members, $1.50; nonmembers, $2.00.

Mounting new pressures are forcing naval aviation away from classic equipment, tactics and procedures that have characterized it for some fifty years. They include cost, manning, performance and a host of factors relating to the U.S. Navy's future role in over-all national policy. These dynamic shifts in emphasis introduce, simultaneously, challenges to be overcome and opportunity to be exploited. This paper explores developing U.S. Navy air mission alternatives, attempts to establish logical and practical links with advanced marine vehicle technology, and describes relationships that bear directly upon the composition, character and quality of naval aviation in the crucial 1980s. T.M.

**A74-21291** # **Wind modification over the flight decks of high-speed ships.** R. D. Murphy (U.S. Navy, Naval Ship Research and Development Center, Bethesda, Md.). *American Institute of Aeronautics and Astronautics and Society of Naval Architects and Marine Engineers, Advanced Marine Vehicles Conference, San Diego, Calif., Feb. 25-27, 1974, AIAA Paper 74-301.* 8 p. Members, $1.50; nonmembers, $2.00.

This paper reports a very limited development effort for an aerodynamic shield to be used during flight operations aboard

high-speed ships. New concepts in ship design will soon be capable of producing deck wind intensities too great for personnel and equipment exposure, yet, aircraft take-off and landing performance could benefit from any increased wind over deck. Modification of the deck winds might allow all preflight/post-flight support necessary. A very limited wind-tunnel evaluation suggests that an effective shield could be developed. Subjected during test to a tunnel wind in excess of 90 knots, the shield modified the local deck winds significantly. A large shielded space was produced. Although the shield is not yet optimized and more development is needed, the simplicity of the aerodynamic principles involved forcasts considerable elasticity in both effectiveness and application. T.M.

**A74-21292** # **A new aircraft/ship mating system.** K. de Booy (Boeing Aerospace Co., Seattle, Wash.). *American Institute of Aeronautics and Astronautics and Society of Naval Architects and Marine Engineers, Advanced Marine Vehicles Conference, San Diego, Calif., Feb. 25-27, 1974, AIAA Paper 74-303.* 6 p. Members, $1.50; nonmembers, $2.00.

Studies of high performance vertical takeoff fighters designed to operate from small ships not equipped with catapults and arresting gear indicate that the tail sitter is the most efficient airplane concept to perform intercept missions. Intercept and air-to-air combat missions reduce takeoff thrust-to-takeoff weight ratios consistent with vertical takeoff requirements. In the tail sitter design, the weight associated with making all of the thrust available for both takeoff and mission performance is minimized. A stabilized landing gantry, aircraft handling, storage and maintenance concept was developed which is a radical departure from the conventional. The resultant airplane/ship system offers potential improvements in aircraft performance and possibly some attractive options in ship design. (Author)

**A74-21293** # **The design application of aircraft securing and traversing systems to the surface effect ship.** C. A. Toche (Litton Systems, Inc., Van Nuys, Calif.). *American Institute of Aeronautics and Astronautics and Society of Naval Architects and Marine Engineers, Advanced Marine Vehicles Conference, San Diego, Calif., Feb. 25-27, 1974, AIAA Paper 74-304.* 8 p. Members, $1.50; nonmembers, $2.00. Contract No. N00024-73-C-0907.

**A74-21294** # **Aircraft/ship interface problems - The U.S. Navy's program.** J. R. Smith (U.S. Naval Air Systems Command, Washington, D.C.) and W. S. Mitchell (Washington Technological Associates, Inc., Rockville, Md.). *American Institute of Aeronautics and Astronautics and Society of Naval Architects and Marine Engineers, Advanced Marine Vehicles Conference, San Diego, Calif., Feb. 25-27, 1974, AIAA Paper 74-305.* 10 p. 13 refs. Members, $1.50; nonmembers, $2.00.

This paper provides an overview of the U.S. Navy helicopter compatibility program on nonaviation ships. It presents a brief history and discussion of the elements and evolution of aviation facilities along with the deficiencies aboard existing ships and the problems in expediting their correction. This is followed by a discussion of some of the major interface problem areas confronted in integrating an effective aircraft-ship system. T.M.

**A74-21320** **General Dynamics lightweight fighter.** C. Gilson. *Flight International*, vol. 105, Feb. 7, 1974, p. 173-176.

According to the regulations of the contract for two prototype YF-16s complete responsibility for design resides with General Dynamics and no detailed military specifications have to be met. The YF-16 shows its advanced technology in several areas, aerodynamically, in its systems, materials, and powerplant. A maximum speed of Mach 2.2 can be reached. The first YF-16 made an unscheduled first flight on January 20 at Edwards Air Force Base, Calif. G.R.

**A74-21335** **International Conference on Cybernetics and Society, Boston, Mass., November 5-7, 1973, Proceedings.** Conference sponsored by the Institute of Electrical and Electronics Engineers. New York, Institute of Electrical and Electronics Engineers, Inc., 1973. 402 p. Members, $15.; nonmembers, $20.

The subjects examined are related to information and education, health care delivery systems, man-machine systems, environmental quality, pattern recognition, transportation, and applications of adaptive techniques. Other areas considered include communication gaps, man in an automated ATC environment, technology and the community, urban emergency services, biocybernetics, optical control theory in economic models, and system theory and applications. Topics in the field of decision analysis are also explored together with subjects in the areas of computers and modeling, pattern discovery, and artificial intelligence. G.R.

**A74-21336** **A direct procedure for partitioning scanning workload with a flight director.** W. F. Clement, L. G. Hofmann, and D. Graham (Systems Technology, Inc., Princeton, N.J.). In: International Conference on Cybernetics and Society, Boston, Mass., November 5-7, 1973, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 38-43. 9 refs. Contract No. F33615-71-C-1349.

Recent experimental eye scanning measurements from simulated approaches in a flight-like cockpit representing a contemporary jet transport have made it possible to simplify the procedure for predicting the partition of the pilot's scanning workload required for monitoring and controlling a task with status displays and a flight director. When there is but a single director control display, the new procedure eliminates iteration in the preliminary design computations. The preliminary design computations are based on predictions of closed-loop input-correlated errors in displayed variables with respect to the trimmed flight values. Also included are methods for predicting multiloop error coherence, and for correcting the predicted partition of scanning workload when the pilot's scanning remnant contribution is significant. (Author)

**A74-21338** * **Digital adaptive model following control.** G. Alag, J. Rondot, and H. Kaufman (Rensselaer Polytechnic Institute, Troy, N.Y.). In: International Conference on Cybernetics and Society, Boston, Mass., November 5-7, 1973, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 104-106. Grant No. NGR-33-018-183.

Development of an implementable digital adaptive control system requires a control law that can be efficiently adjusted during system operation and an identification algorithm that is capable of supplying parameter estimates at an accuracy and rate specified by the controller characteristics. To this effect a control law has been derived based upon the minimization of a weighted combination of the instantaneous squared error between the states of a linear plant and model at the next stage and the present control energy. The result is a control signal that is a linear combination of plant states, model states, and any model inputs. Explicit formula are available for computing the pertinent gains. To illustrate the utility of such a control law, its application to typical linearized lateral aircraft dynamics is currently being considered. T.M.

**A74-21340** **The automatic aircraft guidance law for mid-air collision avoidance.** S.-C. Huang and A. Joshi (Syracuse University, Syracuse, N.Y.). In: International Conference on Cybernetics and Society, Boston, Mass., November 5-7, 1973, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 133-138. 6 refs.

The air traffic control problem is a complicated yet important problem which needs to be solved by the interdisciplinary approach of modern technology. In this paper we obtain the automatic

optimal guidance law and the guided optimal trajectories for two aircraft to avoid mid-air collision in the terminal area. The paper consists of two parts. The first part formulates the two aircraft collision problem into the framework of control theory. In the second part, the maximum principle is used to obtain a numerical procedure. Two cases of head-on collision were simulated by a computer APL Program. (Author)

**A74-21641** # **Simulation studies of an airport noise silencer (Badania modelowe lotniskowego tlumika halasu).** A. Kowalewicz and W. Jarzebowski. *Instytut Lotnictwa, Prace,* no. 55, 1973, p. 3-20. 6 refs. In Polish.

Description of gasdynamic and acoustic measurements performed with two prototype versions of mufflers designed to suppress noise emission from the exhaust of jet aircraft engines in operation at or near airports. The two prototypes resulted from preliminary gasdynamic calculations and performance analyses. Structural details are illustrated, and results of compressed-air tests are given in graphs illustrating velocity distributions and exhaust noise spectra. T.M.

**A74-21705** **Helicopter windlass rescue with the Alouette III (Die Hubschrauberwindenbergung mit der Alouette III).** E. Jenny. *Wehrmedizinische Monatsschrift,* vol. 18, Feb. 1974, p. 39-45. In German.

The rescue of persons injured by accidents in high mountains from a hovering helicopter by means of a cable winch was first carried out in 1970 in Austria by the Austrian Bundesheer (Federal Army). The technique of helicopter windlass rescue and the necessary rescue apparatus have been further developed and improved since then, in association with the Austrian Mountain Rescue Services. In order to guarantee the reliability of this type of rescue, a cadre of air-rescue men was continuously trained by army personnel. (Author)

**A74-21726** **The Fairchild Industries A-10 - Designed for close air support.** J. P. Geddes. *Interavia,* vol. 29, Feb. 1974, p. 119-122.

As a result of the experience provided by the war in Vietnam and of studies concerning the situation in Europe, prototypes of an aircraft for close air support were built. On Jan. 18, 1973 it was announced that Fairchild's A-10 had won the competition. A contract for ten preproduction aircraft was awarded and preparatory steps leading to the production of 600 A-10s beginning in 1975 were considered. Details of A-10 aircraft design are discussed together with aspects of the A-10 systems, questions of survivability, maintenance considerations, and problems of procurement. G.R.

**A74-21727** **The HS.146 - A four-jet feeder-liner.** *Interavia,* vol. 29, Feb. 1974, p. 127-129.

The passenger cabin of the standard aircraft (HS.146-100) is 15.42 m long and 3.20 m wide at floor level. The 'standard' configuration provides seats for 71 passengers. For use on high-density routes, Hawker Siddeley is offering a stretched Dash-200 version which provides better operating economics. Power for the HS.146 will be provided by four Avco Lycoming ALF 502H high-bypass turbofans. G.R.

**A74-21728** * **The augmentor wing - Powered-lift STOL a proven concept.** D. C. Whittley (Havilland Aircraft of Canada, Ltd., Downsview, Ontario, Canada). *Interavia,* vol. 29, Feb. 1974, p. 143-145. Research supported by the Department of Industry, Trade and Commerce and NASA.

A jet-STOL powered-lift aircraft has the ability to perform a relatively steep (7.5 deg) final approach at high power setting and a low speed. The DHC-5 Buffalo/Spey Augmentor-Wing research aircraft is the first machine of its kind to accomplish this performance. The aircraft uses an approach in which the cold bypass thrust is vectored by the augmentor flap. Aspects of aircraft reliability are discussed together with taxi trials, stalling characteristics, lateral directional control, single-engine operations, roll acceleration, and flight in turbulent conditions. G.R.

**A74-21929** **Acoustic holography in solids.** H. K. Wickramasinghe. In: Ultrasonics international 1973; Proceedings of the Ninth Conference, London, England, March 27-29, 1973. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1973, p. 283, 284.

The hologram is derived from the free surface of the sample by the phase modulation of a laser beam, the phase modulation being converted into amplitude modulation by making the hologram surface one mirror of a very close-spaced Fabry-Pérot resonator. The use of this optical resonator system brings two main benefits. Firstly, the region where the laser beam carries phase information is confined to the space between the mirrors, which can with advantage be made very narrow (typically less than 1/2 mm). The requirements on the mechanical stability of the rest of the apparatus are, therefore, very modest. Secondly, the use of the Fabry-Pérot gives rise to a very substantial increase in sensitivity, limited only by the maximum reflectivity and losses in the mirrors. Frequencies of 150 MHz have been used, resulting in a resolution of 90 micrometers. F.R.L.

**A74-21781** # **Studies of an elastic wing (Badania sprezystego skrzydla).** J. Wolf. *Instytut Lotnictwa, Prace,* no. 56, 1973, p. 3-15. 10 refs. In Polish.

Description of design calculations, aerodynamic tests, and mechanical endurance measurements of an experimental sail-like wing consisting of a stretched flexible membrane made from durable synthetic cloth. The symmetry axis of the membrane is attached to a longitudinal beam, and the wing-tips are anchored to the ends of a transverse spar. The proposed flexible wing exhibits higher aerodynamic efficiency and a better polar curve than the Rogallo wing while maintaining the structural simplicity of the latter. Application is suitable for flight velocities from 20 to 150 km/hr. T.M.

**A74-21784** # **An attempt at describing the steady-state performance characteristic of a turbojet engine by a formulated relationship (Proba okreslenia charakterystyki statycznej turbinowego silnika odrzutowego w postaci zaleznosci wyrazonej wzorem).** F. Lenort and D. Gruszczynski. *Instytut Lotnictwa, Prace,* no. 56, 1973, p. 55-67. 18 refs. In Polish.

**A74-21820** # **Flight test of the ski equipped Mohawk.** D. B. Small (Grumman Aerospace Corp., Bethpage, N.Y.). *Canadian Aeronautics and Space Journal,* vol. 20, Jan. 1974, p. 1-14. 10 refs.

The experimental Mohawk skis with the wheels protruding below the teflon coated planing surface were flight tested. The tests of the experimental skis demonstrated conclusively that a planform of this type, while acceptable for some aircraft, was unsatisfactory for use on the Mohawk. Design studies were made indicating that radical changes would be required in the final design of the prototype skis. The planform of the teflon bottomed prototype skis presented the following changes and improvements to the Mohawk ski: (1) an increase in the main ski area, which reduces the loading from 360 to 210 lb/sq ft, resulting in lower bearing pressures and shallower penetrations; (2) teflon bottoms which make an excellent sliding surface; and (3) symmetrical planforms with no tire cutouts, which provides for a continuous running or planing surface. Flight test of the prototype skis were successfully conducted in depths of all types of snow ranging from 2 in. to 3.5 ft. The prototype skis planed over all snow surfaces encountered, at less than 20% of the

engine power required for the experimental skis and with no indication of snow plowing or wallowing. These tests satisfactorily demonstrated the prototype wheel-ski combination installation in the Mohawk. (Author)

**A74-21821** # **The single-engine turboprop in the northern frontier.** R. L. Newman, J. J. Petraits, and J. D. Flanders (General Motors Corp., Detroit Diesel Allison Div., Indianapolis, Ind.). *(Canadian Aeronautics and Space Institute, Annual General Meeting, Edmonton, Canada, May 14, 1973.) Canadian Aeronautics and Space Journal*, vol. 20, Jan. 1974, p. 15-20. 11 refs.

The operational environment of the Canadian Frontier makes a strong argument for a light, single-engine turboprop airplane. The requirements call for a light, reliable engine to maximize the payload capacity of these 'Bush Airplanes.' The geographical location and remote landing sites lead to emphasized takeoff and climb performance over cruise speed and altitude capabilities. The acceptance of the light turboshaft engine in the helicopter market has set a precedent where similar engine requirements of maximizing available takeoff power and payload capability have resulted in the rapid switch to turbine power. Operating cost characteristics of single-engine turboprop aircraft are compared to current designs to permit an evaluation of operations where turbine power can increase profit potential. (Author)

**A74-21874** # **The environment and the gas turbine.** A. H. Lefebvre and R. S. Fletcher (Cranfield Institute of Technology, Cranfield, Beds., England). In: Symposium on the Environment and Transport Technology, Loughborough University of Technology, Loughborouh, Leics., England, September 10-13, 1973, Proceedings. Volume 2. Loughborough, Leics., England, Loughborough University of Technology, 1973, p. D.17.1-D.17.25. 18 refs.

The major pollutants produced by gas turbines and the manner and extent to which their exhaust concentration varies with combustor design and engine operating conditions are discussed. Various techniques for reducing emission levels are described, including rich and lean primary zones, water injection, compressor air bleed, variable geometry, and staged combustion. It is suggested that the 1979 U.S. EPA emission standards for aircraft can be met by relatively straightforward modifications to the combustor combined with the use of compressor air bleed at idling. Reference is made to the contribution made toward easing the emissions problem by a reduction in engine specific fuel consumption. F.R.L.

**A74-22102** **Airplane nacelle composite structure technology.** L. D. Christensen and R. N. Holmes (Doulgas Aircraft Corp., Long Beach, Calif.). In: Polymeric materials for unusual service conditions; Proceedings of the Conference, Moffett Field, Calif., November 29-December 1, 1972. New York, Wiley-Interscience, 1973, p. 3-19. 10 refs.

A method of composite integral construction is described which shows potential for satisfying most of the requirements posed on commercial jet aircraft nacelles. Among these requirements are: sustained high-temperature operation and intermittent environmental operating extremes under flight loads; severe sonic fatigue conditions; fire burnthrough resistance; and sound attenuation capability. The development and application of a glass fiber/polyimide resin configuration is described, and test-stand data obtained with a full-scale glass/polyimide inlet acoustical liner intended for an advanced technology airplane are examined. V.P.

**A74-22206** **Vortexes in aircraft wakes.** N. A. Chigier. *Scientific American*, vol. 230, Mar. 1974, p. 76-83.

The advent of the jumbo jets has turned the well known aerodynamic phenomenon of trailing-vortex air turbulence into a potentially serious hazard to smaller following aircraft. The main objectives of current research problems have been (1) to ascertain the nature, strength, and persistence of the vortexes for various kinds of aircraft; (2) to develop a practical means of reducing the hazard on existing aircraft by artificially inducing the vortexes to break up, and (3) to set up monitoring and control systems at airports in order to prevent aircraft from entering the vortex-wake turbulence of larger aircraft. F.R.L.

**A74-22225** # **Dynamic stability of sweptback aircraft wings under the action of variable aerodynamic forces (Stabilitatea dinamica a aripilor de avion in sageata sub actiunea fortelor aerodinamice variabile).** N. D. Popescu (Petrosani, Institutul de Mine, Petrosani, Rumania). *Transporturi Auto, Navale si Aeriene*, vol. 3 (20), Dec. 1973, p. 653-665. 9 refs. In Rumanian.

Analysis of the phenomenon of dynamic instability (or aeroelastic divergence) of sweptback aircraft wings under conditions where the aerodynamic pressure varies sinusoidally in time or varies in the form of periodically recurring triangular pulses. For the purposes of this study a wing of this type is approximated by a thin-walled cantilevered bar of closed profile the cross section of which varies along the wing span. A system of four Hill-type differential equations is obtained for determining the stability of the vibrational motion of a sweptback wing considered within the framework of such an approximation. This system of equations is then solved for two types of variation of aerodynamic pressure - one where the aerodynamic pressure has a continuous harmonic variation, and the other where the aerodynamic pressure varies in the form of various types of periodically recurring triangular pulses, including pulses in the shape of arbitrary triangles, pulses in the shape of isosceles triangles, and sawtooth pulses. A.B.K.

**A74-22244** **On the effect of quieter aircraft engines on noise and number index /NNI/ values.** D. Thomas and J. Zarzycki (South Bank, Polytechnic, London, England). *Journal of Sound and Vibration*, vol. 32, Jan. 22, 1974, p. 283-285.

An expression for the resultant change in NNI is recorded, and some of the numerical results obtained from it are given. Examination of the Wilson Committee's expression (1963) for NNI shows the NNI values to be linearly dependent on both the logarithmic average perceived noise level (expressed in PNdB) and the logarithm of the number of aircraft movements taking place in a 12-hr period. Consequently any change in observed NNI value brought about by a given change in flying conditions is independent of the original NNI value. It is then meaningful to calculate changes in NNI without reference to the original value. F.R.L.

**A74-22270** # **Calculation and observance of landing parameters for the aircraft IL-62 and their effect on the safety factor (Berechnung und Einhaltung der Landeparameter für den Flugzeugtyp IL-62 und ihr Einfluss auf den Sicherheitsfaktor).** K. Beck and W. Hertwig (Gesellschaft für Internationalen Flugverkehr mbH, Berlin, East Germany). *Technisch-ökonomische Informationen der zivilen Luftfahrt*, vol. 9, no. 6, 1973, p. 311-321. In German.

The safe performance of a landing operation is only possible if the admissible landing weight of the aircraft is not exceeded. The value of the admissible landing weight depends on the length of the runway and the existing meteorological conditions. Other important parameters for a safe landing are the speed which the aircraft has at the beginning of the glide path and the altitude of the aircraft at this moment. Approaches for the determination of these landing parameters are discussed, giving attention also to the value of the safety factor applying under various conditions of operation and environment. G.R.

**A74-22272** # **The Dolphin airship with undulating propulsion system - A new form of the evaluation factor (Delphinluftschiff**

**mit Wellantrieb - Neue Form der Wertigkeitszahl).** W. Schmidt (KdT-Arbeitsausschuss zum Studium der Luftschiffahrt, Dresden, East Germany). *Technisch-ökonomische Informationen der zivilen Luftfahrt*, vol. 9, no. 6, 1973, p. 351-354. 7 refs. In German.

The airship evaluation factor due to Jaray and reported by Pfeiffer (1935) is considered. The evaluation factor is the ratio between propulsion efficiency and air resistance coefficient. In the case of the Dolphin airship, the evaluation factor in its present form cannot be used due to the impossibility of a separate determination of the two parameters involved in the ratio. A new evaluation factor is, therefore, derived and used for the evaluation of a number of airships. G.R.

**A74-22273** # **Aerodynamic analysis of various flight conditions of conventional aircraft. IX - Aerodynamic foundations /General Survey/ (Flugmechanische Analyse verschiedener Flugzustände konventioneller Flugzeuge. IX - Aerodynamische Grundlagen /Allgemeines/).** F. Seidler (Hochschule für Verkhehrswesen, Dresden, East Germany). *Technisch-ökonomische Informationen der zivilen Luftfahrt*, vol. 9, no. 6, 1973, p. 355-364. In German.

**A74-22283** # **Numerical solution of the problem of supersonic gas flow over the upper surface of a delta wing in the expansion region (Chislennoe reshenie zadachi obtekaniia verkhnei poverkhnosti treugol'nogo kryla v oblasti rasshireniia sverkhzvukovym potokom gaza).** G. P. Voskresenskii. *PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki*, Nov.-Dec. 1973, p. 76-81. 7 refs. In Russian.

**A74-22304** # **Flow of hydrogen-oxygen mixtures around blunted bodies moving at high velocity (Obtekanie dvizhushchikhsia s bol'shoi skorost'iu zatuplennykh tel smes'iu vodoroda s kislorodom).** S. Iu. Cherniavskii, N. N. Baulin, and A. S. Mkrtumov. *Fizika Goreniia i Vzryva*, vol. 9, Nov.-Dec. 1973, p. 786-791. 6 refs. In Russian.

# STAR ENTRIES

**N74-15700** Washington Univ., Seattle.
**A PREDICTION MODEL FOR WAKE RELATED SOUND GENERATION BY SINGLE AIRFOILS AND SUBSONIC ROTORS Ph.D. Thesis**
Larry Trumbull Clark 1973 159 p
Avail: Univ. Microfilms Order No. 73-27642

A model for the prediction of wake related sound generation by a single airfoil is presented. The basis of the model is an assumption that the net force fluctuation on an airfoil may be expressed in terms of the net momentum fluctuation in the near wake of the airfoil. This near wake model results in the forcing function for sound generation being the spectra of the two point velocity correlations in the turbulent region near the airfoil trailing edge. The single airfoil result was extended to a rotor geometry and comparisons studied for various aerodynamic parameters. The motion of the source was found to influence the spectrum of radiated sound very little. This was due to the relatively broad band spectrum of the source. Sample computations were made for large subsonic rotors and the noise levels due to the wake mechanism alone were found to be significant.
Dissert. Abstr.

**N74-15701#** Pisa Univ. (Italy).
**A METHOD FOR MEASURING THE DYNAMIC STABILITY CYR IN A SUBSONIC WIND TUNNEL [UN METODO PER LA MISURA DELLA DERIVATA DINAMICA DI STABILITA CYR IN GALLERIA AERODINAMICA SUBSONICA]**
G. Barsotti, C. Casarosa, and G. Rossi 1972 36 p refs In ITALIAN
(Rept-1427) Avail: NTIS HC $4.00

A method is described for measuring the dynamic stability derivative by means of the free oscillations of a model in a wind tunnel. This method is based on the measurement of the existing phase between a signal proportional to the deviation of the model, and a signal proportional to the angle of rotation. The stability derivative of an aircraft model with delta wings is determined, and the results compared to those derived by other methods: Transl. by F.O.S.

**N74-15702#** Weapons Research Establishment, Salisbury (Australia).
**DESCRIPTION OF SIX DEGREE OF FREEDOM RIGID AIRCRAFT MATHEMATICAL MODELS**
J. A. Rein, J. E. Barrett, and R. Wilson Mar. 1973 67 p refs
(WRE-TN-901(WR/D)) Avail: NTIS HC $5.50

The development of a mathematical model for investigating the flight dynamics of a high speed aircraft is discussed. The mathematical model requires a data store containing the physical parameters of the aircraft under study, the static aerodynamic force and moment coefficients as nonlinear functions of the Mach number, angle of incidence and yaw, and the aerodynamic derivatives with respect to roll, pitch, and yaw rates tabulated against Mach number and angle of incidence. Simulation of the aircraft motion is then performed by solving the six degree of freedom Euler equations of motion for a rigid body, referred to body axes through the center of mass. Author

**N74-15703*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**FIXED-BASE SIMULATION STUDY OF DECOUPLED CONTROLS DURING APPROACH AND LANDING OF A STOL TRANSPORT AIRPLANE**
G. Kimball Miller, Jr., Perry L. Deal, and Robert A. Champine Washington Feb. 1974 63 p refs
(NASA-TN-D-7363; L-8825) Avail: NTIS HC $3.50 CSCL 01B

A fixed-base visual simulation study has been conducted to evaluate the use of decoupled controls as a means for reducing pilot workload during approach and landing of an externally blown jet-flap short take-off and landing (STOL) transport. All six rigid-body degrees of freedom were employed with the aerodynamic characteristics based on wind-tunnel data. The primary piloting task was to use a flight director to capture and maintain a two-segment glide slope, with a closed-circuit television display of a STOL airport used during simulations of the flare and landing. The decoupled longitudinal controls used constant prefilter and feedback gains to provide steady-state decoupling of flight-path angle, pitch angle, and forward velocity. The pilots were enthusiastic about the decoupled longitudinal controls but believed the decoupled concept offered no significant advantage over conventional controls in the lateral mode. Author

**N74-15704*#** Calspan Corp., Buffalo, N.Y.
**ANALYSIS OF THE FLOW ABOUT DELTA WINGS WITH LEADING EDGE SEPARATION AT SUPERSONIC SPEEDS**
Joseph P. Nenni and Chee Tung [1974] 43 p refs
(Contract NAS1-11577)
(NASA-CR-132358) Avail: NTIS HC $4.25 CSCL 01A

A research program was conducted to develop an improved theoretical flow model for the flow about sharp edge delta wings with leading-edge separation at supersonic speeds. The flow model incorporates a representation of the secondary separation region which occurs just inboard of the leading edge on such wings and is based on a slender-wing theory whereby the full three-dimensional problem is reduced to a quasi two-dimensional problem in the cross-flow plane. The secondary separation region was modeled by a surface distribution of singularities or a linearized type of cavity representation. The primary vortex and separation were modeled by a concentrated vortex and cut in the cross-flow potential which represents its feeding sheet (in the sense of Brown and Michael). The formulation is made determinate by requiring that the stream lines in the cavity region be conical rays, by imposing a cavity closure condition, by applying a Kutta condition at the wing leading edge, and by requiring that the primary vortex and its feeding sheet be force free. The flow model reduces to that of Brown and Michael in the limit of zero cavity width. Author

**N74-15705#** Naval Ship Research and Development Center, Bethesda, Md.
**A LINEARIZED THEORY FOR THE UNSTEADY MOTIONS OF A WING IN CURVED FLIGHT**
Edwin C. James Aug. 1973 29 p refs
(ZR0230101)
(AD-769671; NSRDC-4098) Avail: NTIS CSCL 20/4

A linearized theory is developed to treat small-amplitude unsteady motions of a wing in curved flight at variable local forward speeds in an inviscid incompressible fluid. The wing geometry, motions, and flight path are specified and the problem is to obtain the time-dependent force, moment, power required to sustain the motion, pressure and velocity fields, and energy loss due to the shedding of vorticity. The theory is expected to provide useful estimates provided the wing does not cross its own wake. The effect of path curvature is a particular interest in this investigation. To contrast this effect, the results can be readily compared with those for a wing in straight-line flight.
Author (GRA)

**N74-15706#** Naval Postgraduate School, Monterey, Calif.
**A NONLINEAR RELAY MODEL FOR POST STALL OSCILLATIONS**
Arthur L. Schoenstadt Sep. 1973 36 p ref
(RR0000150)
(AD-769405; NPS-53ZH73091A) Avail: NTIS CSCL 01/1

A simplified non-linear relay model is developed to describe observed post-stall oscillations in aircraft. The predictions of

the model are evaluated against results obtained by numerical techniques, and shown to yield close agreement. Author (GRA)

**N74-15707#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**AN EXPERIMENTAL INVESTIGATION OF A HIGH LIFT DEVICE ON THE OWL WING M.S. Thesis**
George William Anderson Mar. 1973 91 p refs
(AD-769492; GAM/AE/73-6) Avail: NTIS CSCL 01/1

A study was made of the aerodynamic function of the combiike fixtures found on the leading edge of owl wings. Microphotographs of an owl's wing showed the comb to resemble a row of spanwise twisted airfoils oriented to form a cascade. Smoke flow visualization tests on an owl wing showed that the comb acts as a cascade which turns the flow close to the wing leading edge in a spanwise direction. Flow visualization experiments were run using flat plate and cambered airfoils with combs in a low speed three-dimensional wind tunnel. Results showed that the leading edge comb produced a stationary spanwise vortex that delays flow separation at high angles of attack. The high lift device was related to the vortex lift phenomena observed on delta wing aircraft. The comb's small relative size, simple structure, and lack of moving parts may make it attractive for aircraft use.
Author (GRA)

**N74-15709#** National Aeronautical Lab., Bangalore (India).
**CHANGES IN FLUTTER RESULTS BY STIFFENING SOME DEGREES OF FREEDOM**
Kurze Mittelung Nov. 1973 11 p refs Transl. into ENGLISH from Z. Flugwiss. (Brunswick), v. 6, 1973 p 213-215
(TR-195) Avail: NTIS HC $3.00 CSCL 01C

A method for conducting a flutter analysis of elastically connected aircraft structures with low masses is presented. In the first step, the flutter results are changes so that the concerned parts appear to be rigidly connected to the main frame. In the second step, the degree of freedom is allowed so that the stiffness of the joint can be arbitrarily chosen. The method has the advantage that in the second step the masses associated with the degree of freedom can be introduced and ascertained through supplementary tests or through calculations. Author

**N74-15710*#** Hydronautics, Inc., Laurel, Md.
**EVALUATION OF EFFECTIVENESS OF VARIOUS DEVICES FOR ATTENUATION OF TRAILING VORTICES BASED ON MODEL TESTS IN A LARGE TOWING BASIN Final Report**
Karl L. Kirkman, Clinton E. Brown, and Alex Goodman Washington NASA Dec. 1973 114 p refs
(Contract NAS1-11389)
(NASA-CR-2202) Avail: NTIS HC $4.25 CSCL 01B

The effectiveness of various candidate aircraft-wing devices for attenuation of trailing vortices generated by large aircraft is evaluated on basis of results of experiments conducted with a 0.03-scale model of a Boeing 747 transport aircraft using a technique developed at the HYDRONAUTICS Ship Model Basin. Emphasis is on the effects produced by these devices in the far-field (up to 8 kilometers downstream of full-scale generating aircraft) where the unaltered vortex-wakes could still be hazardous to small following aircraft. The evaluation is based primarily on quantitative measurements of the respective vortex velocity distributions made by means of hot-film probe traverses in a transverse plane at selected stations downstream. The effects of these altered wakes on rolling moment induced on a small following aircraft are also studied using a modified lifting-surface theory with a synthesized Gates Learjet as a typical example. Lift and drag measurements concurrently obtained in the model tests are used to appraise the effects of each device investigated on the performance characteristics of the generating aircraft.
Author

**N74-15711*#** Boeing Vertol Co., Philadelphia, Pa.
**V/STOL TILT ROTOR AIRCRAFT STUDY: WIND TUNNEL TESTS OF A FULL SCALE HINGELESS PROP/ROTOR DESIGNED FOR THE BOEING MODEL 222 TILT ROTOR AIRCRAFT**
J. P. Magee and H. R. Alexander Oct. 1973 873 p refs
(Contract NAS2-6505)
(NASA-CR-114664; D222-10059-1) Avail: NTIS HC $45.75 CSCL 01C

The rotor system designed for the Boeing Model 222 tilt rotor aircraft is a soft-in-plane hingeless rotor design, 26 feet in diameter. This rotor has completed two test programs in the NASA Ames 40' X 80' wind tunnel. The first test was a windmilling rotor test on two dynamic wing test stands. The rotor was tested up to an advance ratio equivalence of 400 knots. The second test used the NASA powered propeller test rig and data were obtained in hover, transition and low speed cruise flight. Test data were obtained in the areas of wing-rotor dynamics, rotor loads, stability and control, feedback controls, and performance to meet the test objectives. These data are presented.
Author

**N74-15712*#** Boeing Commercial Airplane Co., Seattle, Wash.
**DESIGN OF A POWERED ELEVATOR CONTROL SYSTEM Final Report**
W. L. B. Glende 22 Jan. 1974 135 p refs
(Contract NAS2-7293)
(NASA-CR-114727) Avail: NTIS HC $8.75 CSCL 01C

The design, fabrication and flight testing of a powered elevator system for the Augmentor Wing Jet STOL Research Aircraft (AWJSRA or Mod C-8A) are discussed. The system replaces a manual spring tab elevator control system that was unsatisfactory in the STOL flight regime. Pitch control in the AWJSRA is by means of a single elevator control surface. The elevator is used for both maneuver and trim control as the stabilizer is fixed. A fully powered, irreversible flight control system powered by dual hydraulic sources was designed. The existing control columns and single mechanical cable system of the AWJSRA have been retained as has been the basic elevator surface, except that the elevator spring tab is modified into a geared balance tab. The control surface is directly actuated by a dual tandem moving body actuator. Control signals are transmitted from the elevator aft quadrant to the actuator by a linkage system that includes a limited authority series servo actuator. Author

**N74-15713*#** Boeing Commercial Airplane Co., Seattle, Wash.
**A STUDY TO DETERMINE THE FEASIBILITY OF A LOW SONIC BOOM SUPERSONIC TRANSPORT Final Report, Nov. 1972 - Jul. 1973**
Edward J. Kane Washington NASA Dec. 1973 129 p refs
(Contract NAS1-11877)
(NASA-CR-2332; D6-41177) Avail: NTIS HC $4.50 CSCL 01C

A study was made to determine the feasibility of supersonic transport configurations designed to produce a goal sonic boom signature with low overpressure. The results indicate that, in principle, such a concept represents a potentially realistic design approach assuming technology of the 1985 time period. Two sonic boom goals were selected which included: (1) A high speed design that would produce shock waves no stronger than 48 Newtons per square meter (1.0 psf); and an intermediate Mach number (mid-Mach) design that would produce shock waves no stronger than 24 Newtons per square meter. The high speed airplane design was a Mach 2.7 blended arrow wing configuration which was capable of carrying 183 passengers a distance of 7000 km (3780 nmi) while meeting the signature goal. The mid-Mach airplane designed was a Mach 1.5 low arrow wing configuration with a horizontal tail which could carry 180 passengers a distance of 5960 km (3220 nmi). Author

**N74-15714*#** McDonnell-Douglas Corp., Long Beach, Calif.
**A STUDY TO DETERMINE THE APPLICABILITY OF NOISE ABATEMENT APPROACH PROCEDURES TO MCDONNELL DOUGLAS AIRCRAFT Final Report**
John A. Painter and James H. Shannon Dec. 1973 59 p
(Contract NAS2-7586)
(NASA-CR-114677; MDC-J6220) Avail: NTIS HC $5.00 CSCL 01C

Analyses of McDonnell Douglas DC-8, DC-9, and DC-10 jet transports were conducted to investigate the applicability of two segment approach noise abatement procedures to these airplanes.

All models had the required glide slope capability at the certified landing flap settings. The DC-8 models would probably be limited to an upper segment glide slope of 5.5 degrees and would probably not be suitable for the two segment procedure in icing conditions. The DC-8 would not be compatible with this procedure at a reduced landing flap setting. The feasibility of installing a two segment approach system in the Douglas-built fleet of commercial jet transports from a hardware viewpoint is discussed. The candidate system consists of a two segment computer plus the necessary peripheral equipment interfaced with the existing autopilot and associated avionics. The required modifications and additions to existing equipment are described and the attendant costs estimated. Potential problems which may be encountered are also discussed. Author

**N74-15715*#** Systems Technology, Inc., Hawthorne, Calif.
**DESIGN OF A FLIGHT DIRECTOR/CONFIGURATION MANAGEMENT SYSTEM FOR PILOTED STOL APPROACHES**
Roger H. Hoh, Richard H. Klein, and Walter A. Johnson Sep. 1973 177 p refs
(Contract NAS2-6441)
(NASA-CR-114688; STI-TR-1015-3) Avail: NTIS HC $11.00 CSCL 01C

The design and characteristics of a flight director for V/STOL aircraft are discussed. A configuration management system for piloted STOL approaches is described. The individual components of the overall system designed to reduce pilot workload to an acceptable level during curved, decelerating, and descending STOL approaches are defined. The application of the system to augmentor wing aircraft is analyzed. System performance checks and piloted evaluations were conducted on a flight simulator and the results are summarized. Author

**N74-15716*#** Hydrospace-Challenger, Inc., San Diego, Calif.
**NOISE MEASUREMENTS OBTAINED DURING ENGINEERING EVALUATION OF TWO-SEGMENT APPROACHES IN A 727-200 AIRCRAFT**
Carole S. Tanner and Ray E. Glass 21 Jan. 1974 54 p
(Contract NAS2-7369)
(NASA-CR-114691; HCI-TR-S-229) Avail: NTIS HC $4.75 CSCL 01C

A series of noise measurements were made during engineering evaluation tests of two-segment approaches in a 727-200 aircraft equipped with acoustically treated nacelles. A two-segment approach having a 6-degree upper glide slope angle intercepting the Instrument Landing System (ILS) 2.9-degree glide slope at an altitude of 690 feet gave a 5-EPNdB decrease in measured noise at distances greater than 3 nautical miles from the runway threshold when compared with a normal ILS approach. Several of the noise measurements were taken under adverse weather conditions which were outside the specified limits of FAR Part 36. This may introduce uncertainties into the data from several approaches. Author

**N74-15717*#** Lockheed-Georgia Co., Marietta.
**C-5A/ORBITER WIND TUNNEL TESTING AND ANALYSIS: PIGGYBACK FERRY Final Report**
K. H. Tomlin, W. T. Blackerby, A. C. Hughes, E. G. Husband, and J. H. Paterson Dec. 1973 239 p refs
(Contract NAS9-13702)
(NASA-CR-133484; LG73ERO193) Avail: NTIS HC $14.00 CSCL 01C

Wind tunnel testing and analytical studies of the feasibility of ferrying the NASA Shuttle Orbiter on the C-5A in a piggyback mode have been accomplished. Testing was conducted in the 8x12 foot low speed wind tunnel using an existing 0.0399 scale C-5A model in conjunction with a NASA 0.0405 scale Orbiter model. Six component force and moment data were measured over a range of pitch and yaw angles to determine lift and drag characteristics, lateral/directional stability characteristics and longitudinal and directional control powers. A description of the wind tunnel test program with a run schedule and the complete plotted data for all the test runs are presented. Initial emphasis was given to determining the effects of the Orbiter above the C-5A and the optimum location for minimum interference on C-5A characteristics. A comprehensive series of cruise configurations were tested including a range of Orbiter longitudinal and vertical locations, incidences, and afterbody fairings. Subsequently, a series of configurations were devised during the test program to determine means of recovering directional stability degradation due to Orbiter interference. Author

**N74-15718*#** Kanner (Leo) Associates, Redwood City, Calif.
**REDUCTION OF AIRCRAFT NOISE IN THE VICINITY OF AIRPORTS**
B. N. Melnikov Washington NASA Feb. 1974 39 p refs Transl. into ENGLISH of "Snizhenie Shuma Samoletov v Okrestnostiakh Aeroportov", paper presented at USSR/US Aeron. Technol. Symp., Moscow, 23-27 Jul. 1973 30 p
(Contract NASw-2481)
(NASA-TT-F-15237) Avail: NTIS HC $4.00 CSCL 01C

The main sources of noise from modern transport aircraft are examined along with currently employed means of minimizing the influence of aircraft noise on communities neighboring air terminal areas. The complexity of the task is elucidated by stressing the importance of unified development and implementation of measures designed to reduce the noise both at the source and along its path of propagation. These measures are identified as specially designed low-noise engines, traffic control and flightmanuever procedures stressing noise abatement, and architectural as well as urban planning guidelines in the growth of nearby communities. Operational examples of noise abatement procedures employed by current Soviet transport aircraft are described, and their effectiveness is evaluated. Author

**N74-15719*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**ACOUSTIC CHARACTERISTICS OF A LARGE-SCALE WIND TUNNEL MODEL OF AN UPPER-SURFACE BLOWN FLAP TRANSPORT HAVING TWO ENGINES**
Michael D. Falarski, Kiyoshi Aoyagi, and David G. Koenig Sep. 1973 82 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62319) Avail: NTIS HC $6.25 CSCL 01C

The upper-surface blown (USB) flap as a powered-lift concept has evolved because of the potential acoustic shielding provided when turbofan engines are installed on a wing upper surface. The results from a wind tunnel investigation of a large-scale USB model powered by two JT15D-1 turbofan engines are presented. The effects of coanda flap extent and deflection, forward speed, and exhaust nozzle configuration were investigated. To determine the wing shielding the acoustics of a single engine nacelle removed from the model were also measured. Effective shielding occurred in the aft underwing quadrant. In the forward quadrant the shielding of the high frequency noise was counteracted by an increase in the lower frequency wing-exhaust interaction noise. The fuselage provided shielding of the opposite engine noise such that the difference between single and double engine operation was 1.5 PNdB under the wing. The effects of coanda flap deflection and extent, angle of attack, and forward speed were small. Forward speed reduced the perceived noise level (PNL) by reducing the wing-exhaust interaction noise. Author

**N74-15720*#** General Electric Co., Pittsfield, Mass.
**PRELIMINARY TESTS OF VULNERABILITY OF TYPICAL AIRCRAFT ELECTRONICS TO LIGHTNING-INDUCED VOLTAGES Final Report**
J. A. Plumer and L. C. Walko Washington NASA Feb. 1974 50 p refs
(Contract NAS3-14836)
(NASA-CR-2350; SRD-72-067) Avail: NTIS HC $3.00 CSCL 01C

Tests made on two pieces of typical aircraft electronics equipment to ascertain their vulnerability to simulated lightning-induced transient voltages representative of those which might occur in flight when the aircraft is struck by lightning were conducted. The test results demonstrated that such equipment can be interfered with or damaged by transient voltages as low as 21 volts peak. Greater voltages can cause failure of semiconduc-

tor components within the equipment. The results emphasize a need for establishment of coordinated system susceptibility and component vulnerability criteria to achieve lightning protection of aerospace electrical and electronic systems. Author

**N74-15722#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
**TABLES FOR FLIGHT TESTS [TABELLENBUCH FUER DEN FLUGVERSUCH]**
1973 113 p In GERMAN
Avail: NTIS HC $7.75

The tables include data on standard atmosphere, calibration velocity determination from pressure gradients, calibration Mach number, and sound velocity. ESRO

**N74-15723#** Battelle Columbus Labs., Ohio.
**DESIGN GUIDE FOR THE USE OF STRUCTURAL SHAPES IN AIRCRAFT APPLICATIONS. PART 1: SELECTION CRITERIA FOR STRUCTURAL SHAPES AND TUBING. PART 2: MANUFACTURING METHODS FOR STRUCTURAL SHAPES AND TUBING Final Technical Report, 1 Aug. 1971 - 30 Jul. 1973**
Sep. 1973 226 p refs
(Contract F33615-71-C-1929)
(AD-769042; AFML-TR-73-211-Pt-1-Pt-2) Avail: NTIS CSCL 01/3

A two-part Design Guide was compiled to provide technical information and data in the production of structural shapes and tubing for aircraft and aerospace requirements. Part I provides selection criteria for shapes and tubing based on availabilities, design tolerances, and mechanical and physical properties. Part II discusses manufacturing methods for fabricating structural shapes and tubing, namely, extrusion, drawing, and form rolling. Also Part II reviews competitive processes for manufacturing structural type components. This Design Guide is intended to assist design engineers in assessing the availability and properties of materials being considered in new or modified aircraft and aerospace systems, and to assist potential manufacturers and suppliers in assessing equipment, tooling, and processing requirements for fabricating structural shapes and tubing. Materials for aerospace requirements covered in the document include high-strength aluminum alloys, titanium alloys, steels, superalloys, refractory metals, and beryllium. Author (GRA)

**N74-15724#** Systems Associates, Inc., Long Beach, Calif.
**US ARMY HELICOPTER ROD END BEARING RELIABILITY AND MAINTAINABILITY INVESTIGATION Final Report**
Sheldon Dockswell and James L. Huffman Jun. 1973 124 p
(Contract DAAJ02-71-D-0003; DA Proj. 1F1-62205-A-119)
(AD-768843; SAI-R72-012; USAAMRDL-TR-73-35) Avail: NTIS CSCL 01/3

The investigation was carried out to identify, isolate, and verify the causes of problems with rod end bearings (REB) used on U.S. Army helicopters and to trace the resulting effects on helicopter availability. Design requirements, quality assurance provisions, maintenance procedures and practices, test requirements, and procurement practices were analyzed to assess their impact upon the current problems. Excessive play between ball and race was found to be the REB's chief failure mode. Design does not adequately contend with a vibratory environment which tends to cause widening of the race. Quality assurance was neither imposed upon the bearing vendors nor demonstrated by airframe manufacturers. A recommendation was made for a specification to be developed to govern existing or new designs, which include a stainless steel ball with a ceramic coating and a graphite race, a slotted spherical bearing, and an elastomeric spherical bearing. The recommended specification for helicopter REB's includes bond and material integrity, loading, vibration, dust, misalignment angle, qualification and conformity requirements. Specific recommendations for improvements to the policies, practices, and procedures are made in the report; hardware improvements are also discussed. Author (GRA)

**N74-15725#** Boeing Vertol Co., Philadelphia, Pa.
**HLH GROUND SUPPORT EQUIPMENT (GSE) PRELIMINARY INVESTIGATION Final Report, Mar. - May 1973**
John M. Corso, Thomas S. Hammer, and Frank J. Kozloski Jun. 1973 124 p
(Contract DAAJ02-72-C-0041; DA Proj. 1F1-62203-A-434)
(AD-768842; D301-10188-1; USAAMRDL-TR-73-52) Avail: NTIS CSCL 01/3

The preliminary study was conducted to determine the GSE required for the heavy-lift helicopter (HLH) early enough in the program to allow ample time for development/procurement of long lead time items. The HLH aircraft systems were analyzed during the preliminary design stage to establish maintenance concepts, identify the necessary organizational and direct support level tasks, and select equipment suitable for performing the tasks identified. The selected equipment was classified as existing as-is, existing requiring modification, or not available and requiring new design and development effort. The elapsed maintenance time and the number of personnel required to perform organizational and direct support level tasks in the Army aviation environment were determined. In some instances, several alternate approaches for GSE were identified which will require trade-offs to complete the equipment selection process. (Modified author abstract) GRA

**N74-15726#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**ANALYSIS OF CONTROL SURFACE AUGMENTATION IN HIGH-PERFORMANCE AIRCRAFT BY THRUST VECTORING M.S. Thesis**
Deas H. Warley, III Mar. 1973 111 p refs
(AD-769495; GAM/AE/73-14) Avail: NTIS CSCL 01/2

The feasibility of engine thrust vectoring for lateral control of aircraft in the high angle-of-attack regime was investigated for an airplane with F-11 characteristics. The technique was found to be effective in increasing the angle-of-attack at which departure occurs. The method used an effective dynamic directional stability parameter to account for the thrust effect alteration of the static lateral stability parameters Cn beta and Cl beta. Although the effective Cl beta sub dyn could not be used to predict departure in the model studied, it was useful in evaluating the effectiveness of the thrust vectoring concepts. Author (GRA)

**N74-15727#** Air Force Materials Lab Wright-Patterson AFB, Ohio.
**CONFERENCE ON TRANSPARENT AIRCRAFT ENCLOSURES**
Robert E. Wittman, comp. Jun. 1973 844 p refs Conf. held at Las Vegas, Nev., 5-8 Feb. 1973
(AF Proj. 7381)
(AD-769344; AFML-TR-73-126) Avail: NTIS CSCL 01/3

The purpose of the report is to make available the technical papers presented at the recent Tenth Conference on Transparent Aircraft Enclosures. This conference was held for the exchange of knowledge on new developments and design concepts concerned with vision areas of crew enclosures. Also to make known the state-of-the-art with respect to transparent plastics, interlayer materials, and glass, of the type suitable for these applications. The papers contained have been reproduced directly from the original manuscripts. Author (GRA)

**N74-15728#** Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
**STUDIES IN LOW SPEED FLIGHT Final Report, 1 Jun. 1971 - 31 Aug. 1973**
Robin B. Gray, Howard M. McMahon, George T. Bird, and John G. Palfery Sep. 1973 14 p refs
(Grant DA-ARO-(D)-31-124-71-G177)
(AD-768858; AROD-10233-1-E) Avail: NTIS CSCL 01/3

A model helicopter hovering flight test facility is briefly described and the results of the study to date are summarized. The objective is to design, construct, and validate a facility which would closely simulate free still-air conditions in a relatively small confined space. Tests in a one-quarter scale prototype using model airplane propellers successfully demonstrated the basic

concept. Results obtained in the larger facility are encouraging and the tests will continue. Author (GRA)

**N74-15729#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**TWO DIMENSIONAL AIR CUSHION LANDING SYSTEM PERIPHERAL JET CONFIGURATION STUDY M.S. Thesis**
John Robert Rogers Mar. 1973 102 p refs
(AD-769494; GAM/AE/73-13) Avail: NTIS CSCL 01/3

A simplified two-dimensional peripheral jet theory for the equilibrium performance of an air cushion vehicle is investigated. The proposed theory intends to yield a rapid prediction of the actual flow rate and actual power requirements for an air cushion landing system in the hover condition. Nine specific nozzle configurations were tested to determine which resulted in the best power-height performance and whether the theory is able to predict the experimental performance. Three single peripheral jet configurations were tested at a trunk pressure of 80 psfg. Six distributed jet configurations were tested at a trunk pressure of 40 psfg. Effects of inward flow injection angles of 30 degrees and 60 degrees were investigated. (Modified author abstract) GRA

**N74-15730#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
**AN INVESTIGATION OF COST FACTORS RELATING TO CLASS 4 AIRCRAFT MODIFICATIONS M.S. Thesis**
Elvis M. Baker, William H. Burgess, and Albert F. Malkiewicz Aug. 1973 139 p refs
(AD-769195; SLSR-18-73B) Avail: NTIS CSCL 15/5

The emphasis on economic use of resources, and the necessity to justify and account for each dollar spent, has required more research into ways and means of collecting costs of public programs. Aircraft modifications have been the subject of increasing concern, and the Air Force has been criticized for not being able to identify all costs of an aircraft modification. The research is an effort to determine what significant costs are involved in Class 4 aircraft modifications, and which of these have been included in modification approval procedures. Present modification processing procedures habe been presented to enable an understanding of how costs have been collected. GRA

**N74-15733#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
**THE IMPACT OF CONVERSION TO THE METRIC MEASUREMENT SYSTEM ON AIRCRAFT MAINTENANCE AT BASE LEVEL M.S. Thesis**
Robert G. Dewey and Wayne A. Mann Aug. 1973 90 p refs
(AD-769186; SLSR-5-73B) Avail: NTIS CSCL 01/3

The conclusions drawn in the thesis indicate that the impact of metric conversion on aircraft maintenance hardware will allow continued use of current shop machinery and servicing equipment with minor modification required in but few cases. The intermix of tools and stock of both dimensions can be accomplished with little difficulty by the user and will require additional storage space throughout the conversion period and for many years thereafter. Technical information will be affected but can assimilate metric in an orderly fashion. GRA

**N74-15735*#** Kanner (Leo) Associates, Redwood City, Calif.
**PRACTICAL EXPERIENCE WITH A DIGITAL ELECTRO-HYDRAULIC ACTUATOR**
J. Tersteegen Washington NASA Feb. 1974 39 p Transl. into ENGLISH of "Praktische Erfahrungen mit einem digitalen elektro-hydraulischen Stellantrieb", West Germany report DFVLR-IB-153-73/26, 1973 40 p
(Contract NASw-2481)
(NASA-TT-F-15292; DFVLR-IB-153-73/26) Avail: NTIS HC $4.00 CSCL 01C

The basic feasibility of a digital electrohydraulic actuator has been demonstrated with the construction of a prototype. Implementation of this project required the development of electrohydraulic 3/2-way valves of high reliability and extremely short operating times. Satisfactory dynamic behavior on the part of the digital actuator is primarily determined by the accuracy of binary throughflow weighting. Detrimental movement (excess movement or movement in the wrong direction) due to inaccurate through-flow weighting or under loads should be avoidable if the output piston is locked until opposed low-level piston movements have been completed. The high-frequency detrimental movement of the digital actuator is filtered out when it is used as an anticipatory control instrument for a power amplifier to which it is connected. Author

**N74-15736*#** Kanner (Leo) Associates, Redwood City, Calif.
**THE DYNAMIC BEHAVIOR OF A DIGITAL ELECTROHYDRAULIC ACTUATOR**
C. Brinckmann Washington NASA Feb. 1974 52 p refs Transl. into ENGLISH of "Zum dynamischen Verhalten eines digitalen elektro-hydraulischen Stellantriebs", West German report DLR-FR-73-106, 1973 53 p
(Contract NASw-2481)
(NASA-TT-F-15295; DLR-FB-73-106) Avail: NTIS HC $4.75 CSCL 01C

An analysis of the dynamic behavior of the digital electrohydraulic actuator (DEHA) is presented, which indicates that an appropriate locking mechanism may allow it to be used under dynamic and static loads. The increase in load capacity is accompanied by an increase in its irregularity of motion, which means increased dynamic loads on the elements attached to it. Cycle time is affected to a limited degree by loads, but inertial load capacity is seriously limited by the magnitude of permissible overshoot; this restriction rules out the use of the DEHA for operating aircraft control surfaces directly. Its use as an anticipatory control unit in a sequential control system is suggested. A locking mechanism helps reduce the danger presented by the inaccurate calibration of throttle orifices, which may become worse over prolonged periods of operation. Author

**N74-15748*#** Linguistic Systems, Inc., Cambridge, Mass.
**METHOD OF CALCULATION OF ANNUAL OVERALL EFFICIENCY OF MODERN WIND-POWER PLANTS**
F. D. Pigeaud Washington NASA Feb. 1974 13 p refs Transl. into ENGLISH from Ingenieur (The Hague), v. 63, no. 47, 23 Nov. 1971 p W137-W140
(Contract NASw-2482)
(NASA-TT-F-15310) Avail: NTIS HC $3.00 CSCL 10B

A method of calculating the annual overall efficiency of modern wind power plants equipped with asynchronous generators is reported that takes into account the annual velocity duration curve at Den Helder, Holland. A comparison is made between variable pitch windmotor and fixed blade windmotor equipped with movable flaps. A careful calculation is recommended in view of rather small differences in efficiency for both systems. Author

**N74-15829#** Aerospace Research Labs., Wright-Patterson AFB, Ohio.
**HOT CORROSION OF METALS, ALLOYS AND CERAMICS Final Report, Jun. 1971 - Jun. 1973**
George F. Uhlig Sep. 1973 11 p
(AF Proj. 7021)
(AD-769340; ARL-73-0147) Avail: NTIS CSCL 11/6

A knowledge of the mechanism of accelerated oxidation due to the presence of sodium sulfate, called Hot Corrosion, on metals is fundamental to the design and improvement of jet aircraft gas turbines. The reaction/vaporization behavior of sodium sulfate on hot pressed oxides and on platinum was studied using continuous weight change versus time measurements. In addition, the hot corrosion behavior of TD Nickel-Chromium was also studied using continuous weight change versus time measurements. The major accomplishments of the research effort are summarized and the publications generated under this program are listed. Author (GRA)

**N74-15830#** Florida Univ., Gainesville. Dept. of Chemistry.
**TRACE SPECTROMETRIC FLAME ANALYSIS AND GAS CHROMATOGRAPHIC DETECTORS RELATED TO JET ENGINE OIL ANALYSIS AND GAS DETECTION Final Report, 1 Nov. 1969 - 31 Aug. 1973**
James D. Winefordner 1973 15 p refs
(Grant AF-AFOSR-1880-70; AF Proj. 9536)
(AD-769298; AFOSR-73-1968TR) Avail: NTIS CSCL 07/3

The report briefly summarizes research on trace spectrometric flame analysis and gas chromatographic detectors related to jet engine oil analysis and gas detection at the University of Florida consists of fundamental, instrumental and applied studies of atomic and molecular emission, atomic absorption, and atomic and molecular fluorescence of gases and of development of gas chromatographic detectors. By means of such studies, new and improved selective, sensitive methods of trace analysis of elements and molecules in the gas state or convertible to the gas state are being developed. Special emphasis has been given to rapid simultaneous and rapid sequential multielement analysis of several elements or species. A list of publications is included. (Modified author abstract) GRA

**N74-15842#** Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
**ENGINEERING ASPECTS WITH SATELLITE COMMUNICATION TERMINALS IN AIRCRAFT**
Kh. Rosenbach Dec. 1972 22 p refs Presented at the 13th Symp. on Tactical Satellite Commun., Oslo, 30 Aug. 1972
(Rept-7-72) Avail: NTIS HC $3.25

Design aspects of satellite communication terminals in aircraft and associated engineering considerations are discussed with respect to relatively stringent target specifications. The units developed and described as examples serve the main purpose of R and D measurements. On the other hand, they may well be considered basic prototypes of future airborne terminals. Author

**N74-15876#** Lincoln Lab., Mass. Inst. of Tech., Lexington.
**THE EFFECTS OF INTERFERENCE ON MONOPULSE PERFORMANCE**
R. J. McAulya 1 Aug. 1973 35 p refs
(Contract DOT-FA72WAI-261)
(AD-769336; TN-1973-30; ESD-TR-73-176) Avail: NTIS CSCL 17/9

The first and second moments of the monopulse azimuth estimates are used to characterize the estimator performance in a background of mainbeam or side-lobe multipath or ATCRBS interference. An exact expression for the bias error is obtained that not only accounts for the bias due to targets separated in azimuth but also demonstrates the effect of fading or signal cancellation. For a target signal at a 20 db signal-to-noise ratio, it is shown that the fading effect produces negligible bias unless the signal-to-interference ratio is between plus or minus 2.5 db. A first order expression for the variance is obtained that demonstrates that an increase in the random error will occur due to the target separation in azimuth and due to signal fades. The exact nature of the bias and variance depend strongly on the relative phase between the target and interference signals with the poorest performance being obtained at the in- and out-of-phase conditions. It is knowledge of this behaviour that is essential in evaluating the idea of azimuth estimation data editing. Author (GRA)

**N74-15906** British Library Lending Div., Boston Spa (England).
**MICROELECTRONIC PHASE SHIFTERS IN X AND Q BANDS**
C. Jousemet 5 Jul. 1973 24 p Transl. into ENGLISH from Rev. Tech. Compagn. France, Thomson-Houston (Paris), v. 4, no. 2, Jun. 1972 p 407-431
(BLL-PO-2988-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

The circuits discussed are three-bit reflection digital shifters operating the X and Q bands and employing PIN diodes. After giving a theoretical exposition about perturbance transmission phase shifters and reflection type 0 to 120 deg phase shifters. Data show how such phase shifters can be constructed in the hybrid integrated microcircuit technique and then gives the results obtained with such devices. Results also show that the phase shifters are compatible with electronic sweep aerials and may make it possible for such aerials to be used in mutiple function airborne radars. Author

**N74-15939*** National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
**AMES RESEARCH FACILITIES SUMMARY 1974**
1974 104 p
(NASA-TM-X-69411) Avail: Technical Information Division, Ames Research Center, Moffett Field, California 94035 CSCL 14B

This book is a summary of selected facilities at AMES Research Center focusing on: (1) subsonic, transonic, and supersonic wind tunnels; (2) high enthalpy and hypersonic wind tunnels, shock tubes, and ballistic ranges; (3) flight simulators; (4) research aircraft; and (5) computers. Author

**N74-15962#** Joint Publications Research Service, Arlington, Va.
**TURBULENT FLOW IN FLEXIBLE PIPES AND RAMJET ENGINES**
14 Dec. 1973 29 p refs Transl. into ENGLISH from Gidromekhan. (Kiev), no. 24, 1973 19 p
(JPRS-60785) Avail: NTIS HC $3.50

Experimental investigations are reported of turbulent flow in flexible pipes, hydro-gas ramjet engine models, and the ballasting method for increasing the thrust of a hydro-gas ramjet engine.

**N74-16102*#** National Aeronautics and Space Administration, Flight Research Center, Edwards, Calif.
**FLIGHT EXPERIENCE WITH A PIVOTING TRAVERSING BOUNDARY-LAYER PROBE**
Lawrence C. Montoya, David A. Brauns, and Ralph E. Cissell Jan. 1974 16 p refs
(NASA-TM-X-56022) Avail: NTIS HC $3.00 CSCL 01D

A pivoting traversing boundary layer probe was evaluated in flight on an F-104 airplane. The evaluation was performed at free stream Mach numbers from 0.8 to 2.0. The unit is described, and operating problems and their solutions are discussed. Conventional boundary layer profiles containing variations in flow angle within the viscous layer are shown for free stream Mach numbers of 0.8, 1.6, and 2.0. Although the unit was not optimized for size and weight, it successfully measured simultaneously flow angularity, probe height, and pitot pressure through the boundary layer. Author

**N74-16164#** Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
**EVALUATION AND REDESIGN OF FAA ALTIMETER PACK**
Randle E. Dukes Oct. 1973 21 p
(AD-769540; DSPT-73-56) Avail: NTIS CSCL 13/4

The Federal Aviation Administration (FAA) has experienced an unacceptable damage rate (33%) in shipment of Station Altimeters. This item represents a cost of $344.00 per unit. Due to a pending contract to purchase 300 new units, plus normal shipments of 200 per year, FAA requested an immediate interim solution to the problem, to be followed by a final package design optimizing shock protection while reducing weight, cube, and cost. Author (GRA)

**N74-16249*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**TRANSPARENT FIRE RESISTANT POLYMERIC STRUCTURES Patent Application**
George M. Fohlen, John A. Parker, and Paul M. Sawko, inventors (to NASA) Filed 29 Jan. 1974 28 p
(NASA-Case-ARC-10813-1; US-Patent-Appl-SN-437556) Avail: NTIS HC $3.50 CSCL 11D

Transparent impact-, heat- and fire-resistant polymeric materials for making windows, windshields and plane canopies were developed. The polymeric materials comprise an epoxy resin cured with an alkoxy boroxine catalyst and a polycarbonate resin, preferably a polyphenolphthalein carbonate resin. Laminates including the advantages of both resins comprise a transparent layer of epoxy resin and a transparent layer of a polycarbonate resin joined together with a transparent adhesive interlayer.
Author

**N74-16250*#** Aluminum Co. of America, New Kensington, Pa. Research Labs.
**EFFECT OF POLYMER COATINGS ON FATIGUE STRENGTH OF ALUMINUM ALLOY 2024 BOX BEAMS Final Report, Apr. 1971 - May 1972**
G. E. Nordmark and R. A. Kelsey May 1972 21 p refs
(Contract NAS2-6415)
(NASA-CR-114699) Avail: NTIS HC $3.25 CSCL 11C

Previous investigators have shown that polymer coatings raise the fatigue strength of metals tested in air to about the same level as that of uncoated specimens tested in vacuum. The results are given of tests to determine if a polymer coating would improve the fatigue strength of built-up aluminum alloy members simulating aircraft construction. Aluminum alloy 2024-T4 riveted box beams were subjected to constant amplitude fatigue tests in air as well as in salt water fog. The coating did not improve the fatigue strength of beams tested in either environment. This is believed to result from the fact that most failures originated at rivet holes, which were isolated from both the coating and the environment
Author

**N74-16259#** Army Materials and Mechanics Research Center, Watertown, Mass.
**EFFECT OF ADHESIVE ON THE IMPACT RESISTANCE OF LAMINATED PLASTICS FOR WINDSHIELD APPLICATIONS**
Joyce L. Illinger and Robert W. Lewis Aug. 1973 20 p ref
(DA Proj. 1T0-62105-A-329)
(AD-769735; AMMRC-TR-73-36) Avail: NTIS CSCL 11/9

Clamped acrylic-polycarbonate laminates show improved resistance to penetration over that shown by either material alone. Use of thermal bonding techniques or brittle adhesives to form a laminate result in a significant decrease in the ballistic resistance. The brittle adhesive induces spallation of the polycarbonate causing a significantly lower impact resistance and changes the mode of failure from ductile to brittle. Flexible transparent polyurethane adhesives were synthesized with systematic variation in proportions of monomer and structure of the soft segments. Ballistic resistance of laminates using these adhesives was improved by forty percent. The change in relative amount of the hard segment had no significant effect upon the impact behavior. Strength of adhesive bonding was varied by a factor of two through changes in laminating temperature. No correlation between bond strength and ballistic performance was found. Thus, laminates using transparent flexible adhesives with sufficient bond strength to prevent delamination upon impact show ballistic resistance up to fifty percent better than the best commercially available transparent impact resistant polymeric material
Author (GRA)

**N74-16322*#** Pennsylvania State Univ., University Park.
**DETERMINATION OF CRITICAL NONDIMENSIONAL PARAMETERS IN AIRCRAFT DYNAMIC RESPONSE TO RANDOM INPUT Topical Report, Nov. 1972 - Jun. 1973**
Stanley E. Hillard and Maurice M. Sevik Washington NASA Jan. 1974 153 p refs
(Contract NAS8-27334)
(NASA-CR-2361) Avail: NTIS HC $4.75 CSCL 01A

The critical parameters of subsonic jet aircraft response in a random atmospheric environment are determined. Equations of motion are presented for semirigid aircraft with a flexiable primary airfoil. However, the analysis is easily extendable to include additional appendage flexibility. The analysis establishes the mechanical admittance values for pitching, plunging, and the first mode effects from wing elastic bending and torsion. Nondimensional parameters are established which allow the representation of all subsonic jet transport aircraft with one nondimensional model. The critical parameters for random forcing are found to be aircraft relative mass, reduced natural and forcing frequencies, and Mach number. Turbulence scale lengths are found to be directly related to the critical values of reduced forcing frequency. Results are given for subsonic craft traveling at constant altitude. Specific values of admittance functions are tabulated at Mach numbers of 0.2, 0.5, and 0.7. The relative mass range covers all aircraft currently in operation.
Author

**N74-16377** Stanford Univ., Calif.
**ACOUSTIC SCATTERING FROM AN AIRCRAFT TRAILING VORTEX Ph.D. Thesis**
Vernon Wayne Ramsey 1973 257 p
Avail: Univ. Microfilms Order No. 73-30463

Acoustic scattering from the velocity field of an aircraft trailing vortex is considered. Although the primary effort is devoted to scattering from the turbulence field, some new results are also presented for scattering from the mean flow component. The turbulence scattering analysis utilizes in combination the local homogeneity and eddy convection theories developed by R. A. Silverman. An interesting point demonstrated by the vortex scattering application is that these local homogeneity and convection models exist more naturally in combination than as isolated techniques. The analysis method thus formulated is especially well adapted to acoustic scattering from turbulent flows in which significant variations of mean flow and turbulence level occur over distances which are not large in comparison to the macroeddy size.
Dissert. Abstr.

**N74-16486#** National Aerospace Lab., Tokyo (Japan).
**SOME CONSIDERATIONS ON THE PERFORMANCE OF THE FAN JET ENGINE**
Tadao Torisaki, Mitsuo Morita, and Shizuo Sekine 1973 32 p refs In JAPANESE; ENGLISH summary
(NAL-TR-317) Avail: NTIS HC $3.75

Thermodynamic cycle calculations of the fan jet engine were made under several conditions of by-pass ratios, cycle pressure ratios, turbine inlet temperatures at sea level, and flight Mach numbers. The optimum condition for the fan engine was decided such that the thrust ratio reached a maximum, thus allowing the engine performance to be evaluated. Optimum fan engine designs were also obtained. Test results show that: (1) optimum condition is obtained when the ratio of the exit velocity of by-passed air flow to that of gas flow is equal to the product of the fan adiabatic efficiency and the low pressure turbine adiabatic efficiency, (2) optimum by passed ratio can be determined from the ratio of the flight velocity to the equivalent velocity of the gas generator, and (3) optimum fan pressure ratio can be considered as the function of flight Mach number only.
Author

**N74-16493*#** General Electric Co., Cincinnati, Ohio. Flight Propulsion Div.
**HYDROGEN-METHANE FUEL CONTROL SYSTEMS FOR TURBOJET ENGINES Final Report**
J. S. Goldsmith and G. W. Bennett Oct. 1973 162 p refs
(Contract NAS3-14319)
(NASA-CR-121247; R74AEG153; TM-73-489) Avail: NTIS HC $10.25 CSCL 21E

Design, development, and test of a fuel conditioning and control system utilizing liquid methane (natural gas) and liquid hydrogen fuels for operation of a J85 jet engine were performed. The experimental program evaluated the stability and response of an engine fuel control employing liquid pumping of cryogenic fuels, gasification of the fuels at supercritical pressure, and gaseous metering and control. Acceptably stable and responsive control of the engine was demonstrated throughout the sea level power range for liquid gas fuel and up to 88 percent engine speed using liquid hydrogen fuel. Author

**N74-16592*#** Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
**APPLICATION OF THE COLLISION-IMPARTED VELOCITY METHOD FOR ANALYZING THE RESPONSES OF CONTAINMENT AND DEFLECTOR STRUCTURES TO ENGINE ROTOR FRAGMENT IMPACT**
Thomas P. Collins and Emmett A. Witmer Aug. 1973 250 p refs
(Grant NGR-22-009-339)
(NASA-CR-134494; ASRL-TR-154-8) Avail: NTIS HC $14.50 CSCL 20K

An approximate analysis, termed the Collision Imparted Velocity Method (CIVM), was employed for predicting the transient structural responses of containment rings or deflector rings which are subjected to impact from turbojet-engine rotor burst fragments. These 2-d structural rings may be initially circular or arbitrarily curved and may have either uniform or variable thickness; elastic, strain hardening, and strain rate material properties are accommodated. This approximate analysis utilizes kinetic energy and momentum conservation relations in order to predict the after-impact velocities of the fragment and the impacted ring segment. This information is then used in conjunction with a finite element structural response computation code to predict the transient, large deflection responses of the ring. Similarly, the equations of motion for each fragment are solved in small steps in time. Also, some comparisons of predictions with experimental data for fragment-impacted free containment rings are presented. Author

**N74-16597#** Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany). Space Div.
**FATIGUE OF SPACECRAFT STRUCTURES Final Report**
Oct. 1973 172 p refs Prepared jointly with Natl. Aerospace Lab.
(Contract ESTEC-1846/72-AA)
(ESRO-CR(P)-322) Avail: NTIS HC $10.75

Structure type and loads to which spacecraft is subjected are described. Similarities between spacecraft fatigue and aircraft fatigue are elaborated. Recommendations to improve testing procedures, involving reductions of test loads and a more realistic simulation of service loads, are given. A manual of design practices against fatigue is proposed. ESRO

**N74-16603#** Naval Ship Research and Development Center, Annapolis, Md.
**INVESTIGATION OF THE FATIGUE BEHAVIOR OF LARGE PROPELLERS Summary Report**
W. Werchniak and E. J. Czyryca Oct. 1973 40 p refs
(SF35342008; SF54541007)
(AD-769466; NSRDC-4166; NSRDC-28-662) Avail: NTIS CSCL 13/10

The report summarizes the findings of an experimental study on the fatigue behavior of a full-size aircraft-carrier propeller and a patrol craft propeller. Supplementary data on the fatigue characteristics of the manganese bronze propeller material were determined. Fatigue life predictions based on nominal stress and fracture mechanics concepts are analyzed and discussed. There is evidence that with accurate inputs as to stress levels and service loadings, the fatigue life of large propellers could be predicted from specimen data using a fracture mechanics approach. Author (GRA)

**N74-16693#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
**AN ANALYSIS OF THE ACQUISITION OF THE F-111A SIMULATORS M.S. Thesis**
Billie Jatzen and Gerald J. Schulke Aug. 1973 62 p refs
(AD-769202; SLSR-33-73B) Avail: NTIS CSCL 15/5

The Department of Defense (DOD) is concerned about the effectiveness of acquisitions with midrange dollar values. In order to ascertain the effectiveness of a specific mid-range dollar value acquisition, the F-111 simulator acquisition was studied and analyzed. The report ascertains the effectiveness of the procurement of the F-111A simulator and comments on the strengths and weaknesses of the acquisition. GRA

**N74-16694#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
**A COMPARATIVE ECONOMIC ANALYSIS OF A LIGHTER-THAN-AIR LOGISTICS SYSTEM M.S. Thesis**
Roy D. Hammesfahr and Thomas R. Hawk Aug. 1973 60 p refs
(AD-769205; SLSR-39-73B) Avail: NTIS CSCL 15/5

Lighter-Than-Air (LTA) vehicles have been used since the 18th century for a variety of purposes, including research, surveillance, and personnel and material transportation. Successful, safe operation of airships is thought to be within the range of modern technology. A comparative economic analysis of available surface and air transportation systems is conducted to identify the least expensive system. In addition, an LTA system is proposed with its estimated cost factors and these costs are compared with the costs of the present day systems to see if the airship could meet logistics requirements and do so at a favorably competitive cost. GRA

**N74-16695#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**AN ANALYSIS OF THE PHASED INSPECTION SYSTEM FOR B-52H AIRCRAFT M.S. Thesis**
Barry L. Barnes Mar. 1973 113 p refs
(AD-769154; GSA/SM/73-2) Avail: NTIS CSCL 15/5

Analysis of a phased aircraft inspection system indicated a wide interval variability between inspections for various aircraft, when the interval was measured in flying hours, calendar days, or sorties between phases. Certain performance measures were identified, such as code 2 and code 3 system malfunctions, late take-offs, mission cancellations, inspect and repair manhours, and aircraft nonavailability. Based on the analysis, costs of phased inspections could apparently be reduced, without a loss of reliability, by increasing the number of flying hours between inspections. (Modified author abstract) GRA

**N74-16704*#** Wisconsin Univ., Milwaukee.
**NUMERICAL CALCULATIONS OF VELOCITY AND PRESSURE DISTRIBUTION AROUND OSCILLATING AIRFOILS**
Theodore Bratanow, Akin Ecer, and Michael Kobiske Washington NASA Feb. 1974 86 p refs
(Grant NGR-50-007-001)
(NASA-CR-2368) Avail: NTIS HC $4.00 CSCL 01A

An analytical procedure based on the Navier-Stokes equations was developed for analyzing and representing properties of unsteady viscous flow around oscillating obstacles. A variational formulation of the vorticity transport equation was discretized in finite element form and integrated numerically. At each time step of the numerical integration, the velocity field around the obstacle was determined for the instantaneous vorticity distribution from the finite element solution of Poisson's equation. The time-dependent boundary conditions around the oscillating obstacle were introduced as external constraints, using the Lagrangian Multiplier Technique, at each time step of the numerical integration. The procedure was then applied for determining pressures around obstacles oscillating in unsteady flow. The obtained results for a cylinder and an airfoil were illustrated in the form of streamlines and vorticity and pressure distributions. Author

**N74-16705#** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
**COLLECTION OF EXPERIMENTAL DATA FOR AIRCRAFT AFTERBODY DRAG IN THE TRANSONIC AND SUPERSONIC RANGE AND COMPARISON WITH THEORETICAL CALCULATION METHODS [ZUSAMMENSTELLUNG EXPERIMENTELLER UNTERLAGEN ZUM HECKWIDERSTAND VON FLUGKOERPERN IM TRANSSCHALL- UND IM UEBERSCHALLBEREICH UND VERGLEICH MIT THEORETISCHEN BERECHNUNGSMETHODEN]**
W. R. Schmidt and E. Herpfer Bonn Bundeswehramt Apr. 1973 118 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-73-27) Avail: NTIS HC $9.00; Bundeswehramt 30 DM

For non-boattailed afterbodies, mean value curves are determined for two- and three-dimensional flows. For the three-dimensional flow, the influence of the following parameters on the afterbody (without jet influence) is discussed and represented graphically: free stream Mach number, afterbody contour, nose contour, fineness ratio of the overall configuration, Reynolds number, angle of attack, boundary layer thickness, sting geometry, afterbody angle, and base-to-cylinder diameter ratio. The effect of the following jet parameters on the afterbody drag is described by a computer program and compared with experimental results: ratio of nozzle exit pressure to free stream pressure, nozzle-to-base diameter ratio, nozzle exit angle, jet Mach number in nozzle exit, ratio of specific heats of jet propellant, base bleeding, free stream Mach number, afterbody angle, and afterbody length. Author (ESRO)

**N74-16707#** National Aerospace Lab., Amsterdam (Netherlands).
**CALCULATION OF THE DISPLACEMENT EFFECT IN TWO-DIMENSIONAL SUBSONIC ATTACHED FLOW AROUND AEROFOILS. EXAMPLES OF CALCULATIONS USING MEASURED DISPLACEMENT THICKNESSES**
W. J. Piers and J. W. Slooff 8 May 1972 40 p refs Sponsored by the Directorate of Materiel Air, Roy. Neth. Air Force
(NLR-TR-72116-U) Avail: NTIS HC $5.00

Using measured displacement thickness, the classical displacement effect on lift and pressure distribution was calculated for a number of air foils in viscous attached flow. For this purpose the displacement concept boundary condition was incorporated in a potential flow calculation method that uses a discretized surface singularity distribution. Comparisons between results of the present calculations and experimental values of lift confirm earlier findings that the classical displacement concept tends to underestimate the total viscous lift loss, especially in cases with large trailing edge angle. This illustrates the need to take more appropriate care of the singular behavior of the flow near the trailing edge. Author (ESRO)

**N74-16708#** Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
**QUASI HOMOGENEOUS APPROXIMATIONS FOR THE CALCULATION OF WINGS WITH CURVED SUBSONIC LEADING EDGES FLYING AT SUPERSONIC SPEEDS Ph.D. Thesis**
Rene Coene Feb. 1973 180 p refs
(VTH-173) Avail: NTIS HC $12.00

A method is developed for the calculation of supersonic wings with planforms characterized by curved subsonic leading edges. The method extends the range of applicability of Germain's and Fenain's homogeneous flow theory, which is valid for supersonic wings with straight leading edges. With boundary conditions at the wing surface and leading edges of polynomial form, the boundary value problems can be reduced to algebraic problems which permit a systematic treatment. Author (ESRO)

**N74-16711** Georgia Inst. of Tech., Atlanta.
**HELICOPTER BLADE-TIP STABILITY IN FORWARD FLIGHT Ph.D. Thesis**
Keith Waldo Shipman 1972 132 p
Avail: Univ. Microfilms Order No. 73-29022

A method for determining rotor blade flutter in forward flight is presented, developed, and applied in this thesis. The unsteady effects of the layers of the helical wake below the rotor are accounted for. Since the blade tangential velocity, and consequently, the aerodynamic damping vary with azimuth, the vorticity shed due to blade oscillations incipient to flutter will be contained within a region on either side of a critical azimuth position. Assuming this region to be small allows the wake system to be two-dimensionalized. The lift deficiency function developed from the new theory is simplified for limiting cases and compared with earlier results obtained for fixed wings and helicopters in hover. It is found to be consistent with earlier results when simplified. The theory is then applied to bending-torsion flutter for the tip segment of a rotor blade. The previously shed wakes are found to be destabilizing. The flutter velocity becomes constant at higher advance ratios. Dissert. Abstr.

**N74-16712** Kansas Univ., Lawrence.
**AN OPTIMAL CONTROL APPROACH TO AIRPLANE STABILITY AUGMENTATION SYSTEMS DESIGN Ph.D. Thesis**
Omar H. Mardam-Bey 1973 198 p
Avail: Univ. Microfilms Order No. 73-30839

Airplane stability augmentation systems have been conventionally designed by using frequency domain techniques of control systems design. With the advances made in the field of optimal control systems, it became necessary to investigate the quality of stability augmentation systems that can be designed by using optimal control. The present work provides an optimal control method by which airplane stability augmentation systems can be designed, and a major objective of the approach is to provide an easily implementable stability augmentation system. An outline of the design procedure is presented. The airplane equations of motion are written in state space form as a linear, time-invariant state equation. Next, the airplane performance, and its desirable response to pilot commands, are described mathematically by a quadratic performance index. The performance index formulation is primarily based on the physical understanding of the airplane performance requirements. Dissert. Abstr.

**N74-16716*#** General Electric Co., Pittsfield, Mass.
**A TEST TECHNIQUE FOR MEASURING LIGHTNING-INDUCED VOLTAGES ON AIRCRAFT ELECTRICAL CIRCUITS Final Report**
L. C. Walko Washington NASA Feb. 1974 78 p refs
(Contract NAS3-14836)
(NASA-CR-2348; SRD-72-065) Avail: NTIS HC $3.75 CSCL 01C

The development of a test technique used for the measurement of lightning-induced voltages in the electrical circuits of a complete aircraft is described. The resultant technique utilizes a portable device known as a transient analyzer capable of generating unidirectional current impulses similar to lightning current surges, but at a lower current level. A linear relationship between the magnitude of lightning current and the magnitude of induced voltage permitted the scaling up of measured induced values to full threat levels. The test technique was found to be practical when used on a complete aircraft. Author

**N74-16717*#** National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
**A SIMPLIFIED FLIGHT-TEST METHOD FOR DETERMINING AIRCRAFT TAKEOFF PERFORMANCE THAT INCLUDES EFFECTS OF PILOT TECHNIQUE**
Terry J. Larson and William G. Schweikhard Washington Feb. 1974 41 p refs
(NASA-TN-D-7603; H-802) Avail: NTIS, HC $3.00 CSCL 01C

A method for evaluating aircraft takeoff performance from brake release to air-phase height that requires fewer tests than conventionally required is evaluated with data for the XB-70 airplane. The method defines the effects of pilot technique on takeoff performance quantitatively, including the decrease in acceleration from drag due to lift. For a given takeoff weight and throttle setting, a single takeoff provides enough data to

establish a standardizing relationship for the distance from brake release to any point where velocity is appropriate to rotation. The lower rotation rates penalized takeoff performance in terms of ground roll distance; the lowest observed rotation rate required a ground roll distance that was 19 percent longer than the highest. Rotations at the minimum rate also resulted in lift-off velocities that were approximately 5 knots lower than the highest rotation rate at any given lift-off distance. Author

**N74-16718*#** McDonnell-Douglas Corp., Long Beach, Calif.
**STUDY OF QUIET TURBOFAN STOL AIRCRAFT FOR SHORT-HAUL TRANSPORTATION. VOLUME 1: SUMMARY Final Report**
Washington NASA Feb. 1974 157 p
(Contract NAS2-6994)
(NASA-CR-2353) Avail: NTIS HC $5.00 CSCL 01C

Conceptual designs of Quiet Turbofan STOL Short-Haul Transport Aircraft for the mid-1980 time period are developed and analyzed to determine their technical, operational, and economic feasibility. A matrix of aircraft using various high-lift systems and design parameters are considered. Variations in aircraft characteristics, airport geometry and location, and operational techniques are analyzed systematically to determine their effects on the market, operating economics, and community acceptance. The total systems approach is considered to be critically important in analyzing the potential of STOL aircraft to reduce noise pollution and alleviate the increasing air corridor and airport congestion. Author

**N74-16719*#** Nielsen Engineering and Research, Inc., Mountain View, Calif.
**CALCULATION OF THE LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF STOL AIRCRAFT WITH EXTERNALLY-BLOWN JET-AUGMENTED FLAPS Final Report**
Marnix F. E. Dillenius, Michael R. Mendenhall, and S. B. Spangler
Washington NASA Feb. 1974 197 p refs
(Contract NAS2-5247)
(NASA-CR-2358) Avail: NTIS HC $5.50 CSCL 01C

A theoretical investigation was made to develop methods for predicting the longitudinal aerodynamic characteristics of externally-blown, jet-augmented wing-flap combinations. A potential flow analysis was used to develop two models: a wing-flap lifting surface model and a high-bypass-ratio turbofan engine wake model. Use of these two models in sequence provides for calculation of the wing-flap load distribution including the influence of the engine wake. The method can accommodate multiple engines per wing panel and part-span flaps but is limited to the case where the flow and geometry of the configuration are symmetric about a vertical plane containing the wing root chord. Comparisons of predicted and measured lift and pitching moment on unswept and swept wings with one and two engines per panel and with various flap deflection angles indicate satisfactory prediction of lift and moment for flap deflections up to 30 to 40 degrees. At higher flap angles with and without power, the method begins to overpredict lift, due probably to the appearance of flow separation on the flaps. Author

**N74-16720*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**COMPUTER PROGRAMS FOR ESTIMATING AIRCRAFT TAKEOFF AND LANDING PERFORMANCE**
Jeff V. Bowles and Thomas L. Galloway Jul. 1973 84 p refs
(NASA-TM-X-62333) Avail: NTIS HC $7.25 CSCL 01C

A set of computer programs has been developed to estimate the takeoff and landing maneuver of a given aircraft. The program is applicable to conventional, vectored lift and powered-lift concept aircraft. Portions of the program may also be used to evaluate the static performance of these types of aircraft. The aircraft is treated as a point mass confined to motion in a vertical plane, and rotational dynamics have been neglected. The required input is described and a sample case is presented. Author

**N74-16722#** National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
**AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, SUPPLEMENTAL ISSUE, 1972 ACCIDENTS**
3 Dec. 1973 106 p
(NTSB-BA-73-10) Avail: NTIS HC $8.50

Reports of aircraft accidents and incidents that occurred in 1972 and have not been included in a prior issue of briefs are presented. Included are eight U. S. Air Carrier Accidents, 47 U. S. Air Carrier incidents, 17 U. S. General Aviation accidents, and 50 U. S. General Aviation incidents. Three Foreign Air Carrier accidents, one Foreign Air Carrier accident which occurred outside the U. S., and 19 Foreign General Aviation accidents that were investigated by the National Transportation Safety Board are also included. This publication is the final issue of Briefs of Accidents that occurred in calendar year 1972. Author

**N74-16726*#** Boeing Commercial Airplane Co., Seattle, Wash.
**THE RESULTS OF A HIGH-SPEED WIND TUNNEL TEST TO INVESTIGATE THE EFFECTS OF THE NASA REFAN JT8D ENGINE NACELLES ON THE STABILITY AND CONTROL CHARACTERISTICS OF THE BOEING 727 AIRPLANE**
E. A. Kupcis Dec. 1973 52 p ref
(Contract NAS3-17842)
(NASA-CR-134545; D6-41499) Avail: NTIS HC $5.75 CSCL 01B

A high speed wind tunnel test was conducted to investigate the effects of the NASA Refan JT8D engine nacelles on the stability and control characteristics of the Boeing 727 airplane. The test was performed at the Calspan Corporation 8x8 ft. (2.44x2.44 m.) transonic wind tunnel. Both the 727-200 and -100 models were tested. A small nose-down pitching moment increment and a slight increase in longitudinal stability were noted due to the Refan nacelles. The directional stability of the 727-200 airplane increased up to 10 percent. A smaller improvement was observed on the 727-100 model. In general, the high speed stability and control characteristics of the basic airplane are not significantly altered by the Refan nacelle installation. Author

**N74-16729*#** Boeing Commercial Airplane Co., Seattle, Wash. Preliminary Design Dept.
**ADVANCED SUBSONIC LONG-HAUL TRANSPORT TERMINAL AREA COMPATIBILITY STUDY. VOLUME 1: COMPATIBILITY ASSESSMENT**
Feb. 1974 186 p refs
(Contract NAS1-12018)
(NASA-CR-132367; D6-22561-Vol-1) Avail: NTIS HC $12.50 CSCL 01C

An analysis was made to identify airplane research and technology necessary to ensure advanced transport aircraft the capability of accommodating forecast traffic without adverse impact on airport communities. Projections were made of the delay, noise, and emissions impact of future aircraft fleets on typical large urban airport. Design requirements, based on these projections, were developed for an advanced technology, long-haul, subsonic transport. A baseline aircraft was modified to fulfill the design requirements for terminal area compatibility. Technical and economic comparisons were made between these and other aircraft configured to support the study. Author

**N74-16730*#** Boeing Commercial Airplane Co., Seattle, Wash. Preliminary Design Dept.
**ADVANCED SUBSONIC LONG-HAUL TRANSPORT TERMINAL AREA COMPATIBILITY STUDY. VOLUME 2: RESEARCH AND TECHNOLOGY RECOMMENDATIONS**
Feb. 1974 159 p refs
(Contract NAS1-12018)
(NASA-CR-132368; D6-22562-Vol-2) Avail: NTIS HC $11.00 CSCL 01C

The Terminal Area Compatibility (TAC) study is briefly summarized for background information. The most important research items for the areas of noise congestion, and emissions

are identified. Other key research areas are also discussed. The 50 recommended research items are categorized by flight phase, technology, and compatibility benefits. The relationship of the TAC recommendations to the previous ATT recommendations is discussed. The bulk of the document contains the 50 recommended research items. For each item, the potential payoff, state of readiness, recommended action and estimated cost and schedule are given. Author

**N74-16732#** Centre d'Essai Aeronautique, Toulouse (France).
**ENDURANCE TESTS ON TRANSPORT AIRCRAFT COCKPIT WINDOW GLASSES [ESSAIS D'ENDURANCE SUR GLACES D'AVION DE TRANSPORT]**
1973 12 p In FRENCH Presented at the Intern. Seminar on Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.00

Results of endurance tests on cockpit window glazing for the European Airbus are reported. The objective of these tests was to demonstrate that if this glazing were exposed to varying environmental conditions during large number of flights, no rupture, delamination or leak would occur, and transparency would remain at an acceptable level. The test parameters are defined, and simplifications are introduced for simulation. The test installation is comprised of a wind tunnel with refrigerator, and two caissons. ESRO

**N74-16733#** Aerospatiale Usines de Toulouse (France).
**USE OF SIMULATION FOR THE DEVELOPMENT OF CONCORDE [UTILISATION DE LA SIMULATION DANS LE DEVELOPPEMENT DE CONCORDE]**
R. Deque and J. Tardy 5 Aug. 1973 10 p In FRENCH Presented at the Intern. Seminar Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.00

The flight simulator for the Concorde aircraft development is described. Several means of simulation have been used, analog as well as hybrid. 9,500 hours of simulation have been accomplished up to now, with the simulator, 3,500 of which were completed before the first flight of the 001 prototype. The tests and corresponding investigations are in 5 categories, which are successively examined: perfectioning of the aircraft and its systems, test flight preparation and crew training, crew workload, operational studies together with Eurocontrol, and preparation for the certification of the aircraft. ESRO

**N74-16734#** Royal Aircraft Establishment, Farnborough (England).
**IN SITU NON-DESTRUCTIVE TESTING OF AIRCRAFT STRUCTURES BY HOLOGRAPHIC INTERFEROMETRY**
M. P. Wright Feb. 1973 13 p refs
(RAE-TR-72218; BR33628) Avail: NTIS HC $4.00

An investigation into a method of non-destructively testing part of an aircraft in situ is described. The method used was double-exposure holographic interferometry whereby two holograms of an object are recorded on the same holographic plate, the only difference being that the object is strained between exposures. The holograms were taken with a pulsed ruby laser and the strain applied by gentle heating. Results indicate that the technique could be successfully applied, for example, to a complete aircraft in a hangar. ESRO

**N74-16737#** Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
**COLUMN FAILURE OF THIN-WALLED COMPRESSION MEMBERS IN AIRCRAFT WINGS AS AFFECTED BY WALL IMPERFECTION AND CRUSHING**
A. VanDerNeut Jun. 1973 22 p refs
(VTH-175) Avail: NTIS HC $4.25

The stiffness reduction of the composing walls of thin-walled compression members, due to initial waviness of the walls, affects the bending stiffness and consequently the buckling load in column failure. When loaded in bending, thin aircraft wings, and consequently the compression members of the wing panels attain noticeable curvature. The bending moment in these members is maximal in the center of the bays between successive ribs and minimal at the supporting ribs (crushing). Therefore, their bending stiffness varies along the bay and differs from the bending stiffness in the absence of crushing. For a representative model the buckling load is established as affected by the crushing parameter. Strength reduction due to crushing is compared to reduction due to wall imperfection alone. Author (ESRO)

**N74-16738#** Texas A&M Univ., College Station. Engineering Experiment Station.
**RESEARCH ON AIRCRAFT DYNAMICS FOR SUBSONIC FLIGHT Final Report, 1 Jun. 1971 - 31 Aug. 1973**
William P. Jones 28 Sep. 1973 8 p refs
(Grant DA-ARO(D)-31-124-71-G153)
(AD-770540; TEES-2809-73-01) Avail: NTIS CSCL 01/3

The report on helicopter dynamics is submitted as a collection of abstracts of papers published or to be published. The principal authors of the papers listed are J. Bicknell, W. P. Jones, and A. G. Parker. GRA

**N74-16739#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**MEASUREMENT OF PRESSURE ON AN OSCILLATING AILERON IN TRANSONIC FLOW**
V. V. Mazarenko and T. P. Nevezhina 29 Oct. 1973 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 2, 1972 p 179-185
(AD-769982; FTD-HT-23-209-74) Avail: NTIS CSCL 01/3

The report gives the results of pressure measurements on an oscillating aileron in plane-parallel transonic flow. The measurements were made using pressure sensors inside the model in a regime of forced oscillations at Mach - 0.974. GRA

**N74-16740#** Kaman Aerospace Corp., Bloomfield, Conn.
**MAINTAINABILITY ANALYSIS OF MAJOR HELICOPTER COMPONENTS Final Report**
Thomas N. Cook, Robert L. Young, and Frank E. Starses Aug. 1973 316 p
(Contract DAAJ02-72-C-0065; DA Proj. 1F1-62205-A-119)
(AD-769941; USAAMRDL-TR-73-43) Avail: NTIS CSCL 01/3

The report examines the factors responsible for the high man-hour cost of maintaining current-inventory Army helicopters. Major components of six helicopter models were analyzed to identify the significant man-hour consumers on each aircraft. Causes for maintenance were established in terms of failure modes, maintenance frequency, and average repair time. Major component replacement tasks were structured in terms of specific time elements, and important factors affecting maintenance task performance were established. The report documents the results of three study tasks. Using data derived from the analysis, a checklist has been developed for use in maintainability analyses of future helicopter designs. (Modified author abstract) GRA

**N74-16741#** General Dynamics/Convair, San Diego, Calif. Aerospace Div.
**DESIGN AND FABRICATION OF A BORON/ALUMINUM COMPOSITE WING BOX TEST SPECIMEN Final Report, Mar. 1972 - May 1973**
William F. Wennhold Jul. 1973 147 p refs
(Contract N62269-72-C-0414)
(AD-770203; CASD-NSC-73-005) Avail: NTIS CSCL 01/3

The report summarizes the design, analysis, fabrication and testing of a wing box specimen using boron aluminum as the primary structural material. The primary purpose of the program was to demonstrate the feasibility of using boron-aluminum in a major aircraft structural component. The wing section selected is typical of many aircraft wing structures and simulated an integral wing fuel tank section capable of withstanding internal pressure in addition to the basic bending and torsion loads. (Modified author abstract) GRA

**N74-16742#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**DROP AND STATIC TESTS ON A TENTH-SCALE MODEL OF AN AIR CUSHION LANDING SYSTEM (ACLS) M.S. Thesis**
Anthony Rodrigues Sep. 1973 161 p refs
(AF Proj. 1369)
(AD-770026; GA/ME/73-3) Avail: NTIS CSCL 01/3

An experimental investigation of the performance of an Air Cushion Landing System (ACLS) on a one-tenth scale model of a CC-115 Canadian aircraft is discussed. Several different types of tests were conducted on an extended version of the ACLS trunk at simulated fullscale trunk pressures of 315 psfg, out of ground effect, and 342 psfg, in ground effect. Cushion pressure was 160 psfg, in ground effect, during hover. The experiments involved: vertical drop tests to measure the effects of sink rate and initial attitude between full-sclae sink rates of 3.0 and 12.5 fps, and attitudes of pitch and roll from 0.0 to 12.0 and 0.0 to 7.5 degrees, respectively; static equilibrium tests to measure vertical stiffness, roll stiffness, pitch stiffness, and floor pressure exerted by the ACLS with loads up to 4.1 times the aircraft landing weight; and braking tests to obtain the effects of changing brake pillow thickness between simulated full-scale heights of 0.0 inches and 26.0 inches. (Modified author abstract) GRA

**N74-16743#** Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
**HIGH ACCELERATION COCKPIT: THE MANEUVERING COUNTERMEASURE**
Philip V. Kulwicki, John P. Lyons, and Richard L. Ravenelle Sep. 1973 18 p Presented at the AFSC Sci. and Eng. Symp., Kirtland AFB, Ohio, 2-4 Oct. 1973
(AF Proj. 7184)
(AD-770287; AMRL-TR-73-93) Avail: NTIS CSCL 01/3

The high acceleration cockpit represents an innovative approach to cockpit design which provides a unique blend of pilot capabilities and airplane performance potential, especially for the counter air mission. By altering the standard cockpit geometry, positive airplane control and tactical decisions are enabled during levels of maneuvering acceleration well above 7G. The result, in the context of emerging fighter capability, is a dramatic increase in combat effectiveness and operational advantage. Author (GRA)

**N74-16744#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**STUDY OF REVERSE-FLOW CHARACTERISTICS OF A TIP FAN AND AN EJECTOR M.S. Thesis**
Ernest Kunstadt Oct. 1973 69 p refs
(AD-770080; GAM/ME/73A-1; AFFDL-TR-73-73) Avail: NTIS CSCL 21/5

An investigation was carried out in order to determine the reverse-flow characteristics of an ejector and a tip-turbine fan. The components tested a model TD-530 ejector and model TD-457 tip-turbine fan manufactured by Tech Development Corporation of Dayton, Ohio. A plenum chamber and air flow system were designed and constructed to permit variation of flow rates and back pressures, as well as fan and ejector driving pressures. Measurements of pressures and temperatures were taken in order to determine air mass flow rates of drive and inlet air as a function of back pressure. Fan speed for the tip-turbine fan was also monitored as a function of back pressure, and various ejector exit conditions were studied to determine their affect on basic ejector performance. The secondary air mass flow rates for both devices were found to be practically linear functions of back pressure, up to and including the reverse-flow regime. The results of these studies are presented in graphical form and discussed. Author (GRA)

**N74-16746#** Army Aviation Systems Command, St. Louis, Mo.
**MAJOR ITEM SPECIAL STUDY (MISS) AH-1G DRIVESHAFT ASSY, MAIN TRANSMISSION TO ENGINE Interim Report, 1 Jan. 1964 - 30 Jun. 1972**
Nov. 1973 23 p refs
(AD-770498; USAAVSCOM-TR-73-27) Avail: NTIS CSCL 01/3

The report is designed to illustrate cost savings which would result from specific efforts in the areas of product improvement in quality and design. For the purpose of this study the cost savings produced in the area of product improvement are based on total elimination of a certain failure mode or modes. GRA

**N74-16747#** Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
**EFFECT OF MODIFIED SEAT ANGLE ON AIR TO AIR WEAPON SYSTEM PERFORMANCE UNDER HIGH ACCELERATION Final Report**
D. B. Rogers, A. B. Ashare, K. A. Smiles, J. W. Frazier, and V. D. Skowronski Jul. 1973 19 p
(AF Proj. 7222)
(AD-770271; AMRL-TR-73-5) Avail: NTIS CSCL 01/3

In air to air combat, the weapons system that has the highest agility and G maneuvering capability has a decided advantage over a less capable system. A method of increasing the G tolerance of the human portion of the system is the use of reclining seats. The modified closed loop Dynamic Environment Simulator system was employed as the experimental test bed for investigation of centrifuge pilots in the reclined position. The centrifuge pilots were required to fly through a series of G on G combat maneuvers and to perform target lock-on and boresight cannon firing through a predictive gunsight reticle at a projected enemy aircraft. The performance scoring was measured as number of ballistic rounds delivered on the target. (Modified author abstract) GRA

**N74-16749#** General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
**AIRCRAFT ANTISKID ANALYSIS VERIFICATION AND REFINEMENT Final Report, Dec. 1970 - Apr. 1973**
Byron H. Anderson Sep. 1973 365 p refs
(Contract F33615-71-C-1109; AF Proj. 1369)
(AD-770300; AFFDL-TR-73-70) Avail: NTIS CSCL 01/3

A program for verifying and refining a previously developed aircraft antiskid performance and system compatibility analysis procedure is described. Analysis verification was performed by comparing antiskid system operation as predicted by the analytical procedures with that recorded during laboratory testing. The laboratory tests were conducted at the Air Force Flight Dynamics Laboratory Landing Gear Test Facility at Wright-Patterson Air Force Base, Ohio using a set-up consisting of F-111 aircraft main landing gear, tire, wheel, brake, hydraulic brake actuation system and several antiskid control circuit variations. (Modified author abstract) GRA

**N74-16750#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**AN EXPERIMENTAL STUDY OF ATTENUATION OF SHOCK WAVES IN AIRCRAFT FUEL TANKS M.S. Thesis**
John R. Breuninger, Jr. Jun. 1973 73 p refs
(AD-769930; GA/MC/73-3) Avail: NTIS CSCL 01/3

When a full, or partially full, aircraft fuel tank is penetrated by a high velocity projectile, a phenomenon known as hydraulic ram effect, created by the passage of a projectile through the fluid often causes massive damage to the tank. This study was conducted to continue experimental investigation of the attenuation of the hydraulic ram effect through addition of a gas to a fuel-foam mixture. The tests were conducted using two types of projectile (1/2 in. steel spheres and 0.50 caliber ogival projectiles) which were fired into a test tank. The tank was filled first with water and then a water/Pneumacel mixture. Four pressure transducers were located in the back wall of the tank and two pressure transducers were located inside the tank to measure the pressure pulses. (Modified author abstract) GRA

**N74-16751#** Rockwell International Corp., Los Angeles Calif. Aircraft Div.
**STOL TACTICAL AIRCRAFT INVESTIGATION, EXTERNALLY BLOWN FLAP. VOLUME 2: DESIGN COMPENDIUM Final Report, 10 Jun. 1971 - 10 Dec. 1972**
Marshall H. Roe, Dirk J. Renselaer, and Ralph A. Quam Apr. 1973 177 p refs 6 Vol.
(Contract F33615-71-C-1760; AF Proj. 643A)
(AD-770110; NA-72-868-Vol-2; AFFDL-TR-73-20-Vol-2) Avail: NTIS CSCL 01/1

The basic objective of the work reported herein was to provide a broader technology base to support the development of a medium STOL Transport (MST) airplane. This work was limited to the application of the externally blown flap (EBF) powered lift concept. The technology of EBF STOL aircraft has been investigated through analytical studies, wind tunnel testing, flight simulator testing, and design trade studies. The results obtained include development of methods for the estimation of the aerodynamic characteristics of an EBF configuration, STOL performance estimation methods, safety margins for takeoff and landing, wind tunnel investigation of the effects of varying EBF system geometry parameters, configuration definition to meet MST requirements, trade data on performance and configuration requirement variations, flight control system mechanization trade data, handling qualities characteristics; piloting procedures, and effects of applying an air cushion landing system to the MST. (Modified author abstract) GRA

**N74-16752#** Rockwell International Corp., Los Angeles Calif. Aircraft Div.
**STOL TACTICAL AIRCRAFT INVESTIGATION-EXTERNALLY BLOWN FLAP. VOLUME 5: FLIGHT CONTROL TECHNOLOGY. PART 2: SIMULATION STUDIES/FLIGHT CONTROL SYSTEM VALIDATION Final Report, 10 Jun. 1971 - 10 Dec. 1972**
James E. Campbell, William K. Elsanker, and Victor H. Okumoto Apr. 1973 210 p refs 6 Vol.
(Contract F33615-71-C-1760; AF Proj. 643A)
(AD-770449; NA-72-868-Vol-5-Pt-2; AFFDL-TR-73-20-Vol-5-Pt-2) Avail: NTIS CSCL 01/3

The basic objective of the work reported was to provide a broader technology base to support the development of a medium STOL Transport (MST) airplane. This work was limited to the application of the externally blown flap (EBF) powered lift concept. From an overall assessment of study results, it is concluded that the EBF concept provides a practical means of obtaining STOL performance for an MST with relatively low risk. (Modified author abstract) GRA

**N74-16753#** Rockwell International Corp., Los Angeles Calif. Aircraft Div.
**STOL TACTICAL AIRCRAFT INVESTIGATION-EXTERNALLY BLOWN FLAP. VOLUME 6: AIR CUSHION LANDING SYSTEM TRADE STUDY Final Report, 10 Jun. 1971 - 10 Dec. 1972**
Robert G. Gustavson Apr. 1973 94 p refs 6 Vol.
(Contract F33615-71-C-1760; AF Proj. 643A)
(AD-770448; NA-72-868-Vol-6; AFFDL-TR-73-20-Vol-6) Avail: NTIS CSCL 01/3

The primary objective of this trade study is to directly install the air cushion landing system (ACLS) as developed by the Flight Dynamics lab, in the MST configuration and compare it with a conventional landing gear. The initial ACLS design was for as large a cushion area as practical. Direct performance comparisons with conventional gear at the same CBR or field rating proved to be difficult with this size cushion. It was decided to try a second ACLS design with four times the cushion pressure of the initial concept. These concepts are called low- and high-pressure ACLS designs, respectively. GRA

**N74-16754#** Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
**AN INVESTIGATION OF AIRBORNE DISPLAYS AND CONTROLS FOR SEARCH AND RESCUE (SAR). VOLUME 9: PROJECT SEA SCANNER AVIONICS AND SENSOR SYSTEM Final Report, Oct. 1972 - Jul. 1973**
R. J. Kirk, F. S. Malver, and W. F. Helmbrecht Jul. 1973 108 p refs 9 Vol.
(Contract N00014-69-C-0460; NR Proj. 213-072)
(AD-770548; Rept-12609-FRI-Vol-9; JANAIR-73-1002) Avail: NTIS CSCL 06/7

A study was conducted to define and select an avionics and sensor system for a U. S. Coast Guard multimission fixed-wing twin-jet aircraft. The system requirements were compiled from previous concept definition studies done under this contract for a search and rescue helicopter and from analysis of mission scenarios fitted to the unique USCG missions. Study tasks included definition of the avionics and sensor requirements to meet mission goals consistent with constraints of a preselected baseline aircraft. A full complement of equipment was recommended along with interface drawings and installation layouts. A system performance specification and subsystem procurement specifications were developed. Author (GRA)

**N74-16755#** Ministry of Defence, London (England).
**REPORT ON THE CONFERENCE ON TRANSPARENT AIRCRAFT ENCLOSURES**
N. S. Corney Jun. 1973 57 p Conf. held at Las Vegas, Nev., 5-8 Feb. 1973
(AD-769372; D-Mat-195; BR36095) Avail: NTIS CSCL 01/3

The report describes papers presented at a conference which was the most recent of a series which has been held over a period of many years sponsored in the main by the U.S. Air Force Materials Laboratory. All aspects of transparencies for fixed wing aircraft and helicopters were covered including rather remote topics such as bird habits and migration studied in connection with the hazard of bird impact on transparencies. From the materials aspect, the most interesting papers were those dealing with experience in the handling and application of polycarbonate as a glazing material. Several papers dealt with the experience gained in service with helicopter transparencies; the accumulation of scratches from general use and from wiper action constitute the most serious deficiency in performance. The need for good hard coatings for plastics materials was emphasized throughout the conference. The design of transparencies to withstand bird impact was the subject of one complete session. Use of laminated polycarbonate with or without glass facing plies constitutes an assembly which will resist four lb birds, but for high reliability such as is needed on civil aircraft the use of all glass panels is common; the introduction of high strength glass enables designs to approach the low overall weight of plastics for the same impact resistance. (Modified author abstract) GRA

**N74-16811#** Centre d'Essai Aeronautique, Toulouse (France).
**ROLE OF COMPUTERIZED SIMULATION IN THE PERFECTING AERONAUTICAL EQUIPMENTS OR SYSTEMS [CONTRIBUTIONS DE LA SIMULATION SUR CALCULATRICE A LA MISE AU POINT D'EQUIPEMENTS OU SYSTEMES AERONAUTIQUES]**
Sep. 1973 29 p In FRENCH Presented at the Intern. Seminar Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.50

The application of new methods of optimization, which exclude empirism by using functional equations verified by experimental results, and computer-aided simulation procedures, are discussed. These methods were applied to aircraft equipment, notably a hydraulic pump and an air intake system for the Concorde aircraft's air conditioning installation. In both cases it is shown that the simulation leads to optimal results. ESRO

**N74-16870#** Army Foreign Science and Technology Center, Charlottesville, Va.
**COMPOSITION AND CHEMICAL STABILITY OF MOTOR FUELS**
Z. A. Zablina 1972 357 p refs Transl. into ENGLISH of the mono. "Sostav i Khimicheskaya Stabilnost Motornykh Topliv" Moscow, 1972 279 p
(AD-770538; FSTC-HT-23-1690-73) Avail: NTIS CSCL 21/4

The work concerns the chemical composition of hydrocarbon motor fuels and the chemical changes that occur from the time the fuels are produced until they are burned in the engine. Chapter

One discusses both the hydrocarbon composition of fuels and the non-hydrocarbon ingredients. Chapter two deals with chemical changes during storage and in engine fuel systems. Chapter Three treats problems of chemical stabilization (chiefly, use of additives). Chapter Four reviews methods for determining the chemical composition of fuels. Chapter Five gives methods for estimating the tendency of fuels toward change. The work is intended for engineers and technicians involved in all phases of production and use of various types of motor fuels, as well as for scientists in petrochemical and refining work. Author (GRA)

**N74-16887*#** Magnavox Research Labs., Torrance, Calif.
**ADVANCED TRACKING AND DATA RELAY EXPERIMENTS STUDY: MULTIMODE TRANSPONDER EXPERIMENT EQUIPMENT Final Report, Sep. 1972 - Sep. 1973**
R. S. Cnossen 15 Sep. 1973 29 p refs
(Contract NAS5-21824)
(NASA-CR-132930; R-4741) Avail: NTIS HC $4.50

Plans and implementation concepts were developed for a series of experiments utilizing a Multimode Transponder mounted in an aircraft working either through a spacecraft or directly with a ground station which would simulate a TDRSS user working through the TDRSS. The purpose of the experiments is to determine the best modulation and encoding techniques for combating RFI in discreet bands. The experiments also determine the feasibility and accuracy of range and range rate measurements with the various modulation and encoding techniques. An analysis of the Multimode Transponder and ground support equipment is presented, and the additional equipment required to perform the experiments described above is determined. Author

**N74-16903#** Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
**FURTHER STUDIES ON SPEECH INTELLIGIBILITY WITH FREQUENCY-MODULATION COMMUNICATION SYSTEMS UNDER FADING CONDITIONS**
D. E. Marquart Oct. 1973 14 p refs Repr. from 16th Symp. on Tactical Satellite Commun. (The Hague) 19 Sep. 1973 p 45-54
(Rept-5-73) Avail: NTIS HC $4.00

The applicability of a method for computing articulation scores to be expected with FM communication systems under arbitrary fading conditions to an experimental helicopter-satellite link is tested. A description of the experiment with respect to intelligibility measurements is followed by the analysis of calculated and measured results which are in good agreement. A discussion of some additional results derived during performance and analysis of experiments is included. ESRO

**N74-16906#** Army Limited War Lab., Aberdeen Proving Ground, Md.
**EVALUATION OF VOICE RECORDERS FOR AIRCRAFT**
Stanley D. Peirce Oct. 1973 11 p
(AD-770517; LWL-TR-74-04) Avail: NTIS CSCL 14/3

The U.S. Army Land Warfare Laboratory evaluated existing tape recorder/reproducers for use as voice monitors in Army surveillance and observation aircraft. It was concluded that none of the tested recorders are capable of meeting the DA Approved Performance Characteristics for Recorder, Voice for Surveillance and Observation Aircraft. However, development of a suitable recorder is well within the state-of-the-art. Author (GRA)

**N74-16953*#** Advisory Group for Aerospace Research and Development, Paris (France).
**ROLL PLANE ANALYSIS OF ON-AIRCRAFT ANTENNAS**
W. D. Burnside (Ohio State Univ.), R. J. Marhefka (Ohio State Univ.), and C. L. Byu (Ohio State Univ.) 30 Jan. 1974 22 p refs Presented at 26th Tech. Meeting of the Avionics Panel of AGARD, Munich, Nov. 1973 Prepared by Ohio State Univ.
(Grant NGR-36-008-144)
(NASA-CR-136815) Avail: NTIS HC $3.25 CSCL 09E

Roll plane radiation patterns of on-aircraft antennas are analyzed using high frequency solutions. Aircraft-antenna pattern performance in which the aircraft is modelled in its most basic form is presented. The fuselage is assumed to be a perfectly conducting elliptic cylinder with the antennas mounted near the top or bottom. The wings are simulated by arbitrarily many sided flat plates and the engines by circular cylinders. The patterns in each case are verified by measured results taken on simple models as well as scale models of actual aircraft. Author

**N74-16960#** Information Systems, Menlo Park, Calif.
**ANTENNA MODELING OF THE KC-135 Final Technical Report**
G. J. Burke, E. S. Selden, and K. Hazard Jul. 1973 183 p
(Contract F30602-72-C-0135)
(AD-769913; IS-R-73/02; RADC-TR-73-195) Avail: NTIS CSCL 09/5

Geometry generators compatible with the RADC Antenna Modeling Program (AMP) and augmented for the KC-135 aircraft electronic test bed configuration for the HF band. Author (GRA)

**N74-16995*#** American Airlines, Inc., Tulsa, Okla.
**FLIGHT EVALUATION OF TWO SEGMENT APPROACHES FOR JET TRANSPORT NOISE ABATEMENT**
Robert A. Rogers, Bernard Wohl, and C. M. Gale Jun. 1973 180 p refs
(Contract NAS2-6501)
(NASA-CR-114735) Avail: NTIS HC $12.00 CSCL 20A

A 75 flight-hour operational evaluation was conducted with a representative four-engine fan-jet transport in a representative airport environment. The flight instrument systems were modified to automatically provide pilots with smooth and continuous pitch steering command information during two-segment approaches. Considering adverse weather, minimum ceiling and flight crew experience criteria, a transition initiation altitude of approximately 800 feet AFL would have broadest acceptance for initiating two-segment approach procedures in scheduled service. The profile defined by the system gave an upper glidepath of approximately 6 1/2 degrees. This was 1/2 degree greater than inserted into the area navigation system. The glidepath error is apparently due to an erroneous along-track, distance-to-altitude profile. Author

**N74-16997#** Calspan Corp., Buffalo, N.Y.
**X-22A FIXED-BASE GROUND SIMULATOR FACILITY Final Report**
T. J. Gavin and R. D. Till Oct. 1973 42 p refs
(Contract N00019-72-C-0380)
(AD-769942; CALSPAN-AK-5113-F-1) Avail: NTIS CSCL 01/3

The report presents a description of the X-22A fixed-base ground simulator facility. The simulation will be used in conjunction with the X-22A V/STOL aircraft which is a unique research tool used in performing flying qualities research. The simulator duplicates the X-22A aircraft and its systems for varying pertinent pitch, roll, yaw and thrust stability derivatives. A high-speed process control digital computer is used to solve the X-22A equations of motion including the nonlinear characteristics associated with transition, and provides the signals for the displays and variable stability system. The X-22A ground simulator is a facility that consists of an air conditioned flight simulation cockpit and a mobile van. (Modified author abstract) GRA

**N74-17001#** Cincinnati Univ., Ohio.
**RESEARCH AND DESIGN OF A SEVENTY-SIX (76) FOOT SPAN AIRCRAFT MAINTENANCE HANGER WITH QUARTER SHELL ENDWALLS Final Technical Report, 21 Dec. 1971 - 1 Feb. 1973**
David L. Hunt, Jack R. Farrah, and James M. Alexander Jul. 1973 225 p refs
(Contract F33615-71-C-1173; AF Proj. 437A)
(AD-770299; ASD-TR-73-31) Avail: NTIS CSCL 15/5

A lightweight, one hundred percent recoverable air-transportable maintenance hangar to accommodate all current Air Force fighter aircraft (F-15, F-111, F-106, A-9, A-10, F-4). The design is specifically for use as part of the inventory of mobility equipment. Major design features are the employment of no-thru metal panels, containerization of the entire structure for transport and the use of folding shell endwalls which provide maximum entry and egress clearances. (Modified author abstract) GRA

**N74-17278#** Reynolds Metals Co., Richmond, Va. Metallurgical Research Div.
**PROGRAM TO IMPROVE THE FRACTURE TOUGHNESS AND FATIGUE RESISTANCE OF ALUMINUM SHEET AND PLATE FOR AIRCRAFT APPLICATIONS**
David S. Thompson, Sander A. Levy, Grant E. Spangler, and David K. Benson Sep. 1973 116 p refs Prepared in cooperation with Midwest Research Inst., Kansas City, Mo.
(Contract F33615-72-C-1202; AF Proj. 7351)
(AD-770350; AFML-TR-73-247-Vol-1) Avail: NTIS CSCL 11/6

A variety of thermomechanical processing practices have been investigated in 2000 and 7000 series alloys. These have been of the form: solution heat treat, quench, preage, work harden and final age. In Task I the effects of Cu (1.9 and 1.3%) and Mg (2.5 and 1.7%) content of 7000 series alloys were evaluated together with the preage and thermomechanical working conditions. It was found that the highest properties were obtained with the lower Cu and Mg contents, with an overaged preage followed by a warm rolling operation. These findings were incorporated in Task II in the choice of alloy (RX725: 6% Zn, 2.4% Mg, 1.5% Cu, and .12% Zr) and by concentrating an overaged, warm rolled processing conditions. It was found that the goals of the contract would be achieved; however, some unexplained low toughness values were obtained. (Modified author abstract) GRA

**N74-17374#** Air Force Weapons Lab., Kirtland AFB, N.Mex.
**UNITED STATES AIR FORCE AIRCRAFT POLLUTION EMISSIONS Final Report, 1 Jan. - 13 Jul. 1973**
Dennis F. Naugle and Bernard T. Delaney Nov. 1973 51 p refs
(AD-769482; AFWL-TR-73-199) Avail: NTIS CSCL 13/2

The interest in pollution emissions from aircraft has been enhanced by Environmental Protection Agency's recent determination that major civilian airports are significant contributors to localized air-quality degradation. This report summarizes the USAF aircraft and engines in common use, presents normalized engine pollution emission factors (emission indices), reviews deficiencies in present emission data, and recommends future efforts to better analyze aircraft emissions. Primary goals of impact assessments at many locations and to stimulate comment on the direction of future USAF efforts concerning the recommended projects. Author (GRA)

**N74-17376#** Office of Naval Research, London (England).
**ATMOSPHERIC POLLUTION BY AIRCRAFT ENGINES**
A. M. Mellor (Purdue Univ.) and Ralph Roberts 1 Aug. 1973 23 p
(AD-769655; ONRL-C-17-73) Avail: NTIS CSCL 13/2

The report summarizes papers delivered at a meeting on the effect of chemical air pollution by aircraft at very high altitudes and near airports. Also discussed are engineering techniques for reducing pollutant production in combustion in aircraft engines. Both the problems of pollution generation as well as diffusion were discussed. (Modified author abstract) GRA

**N74-17519#** RAND Corp., Santa Monica, Calif.
**TECHNOLOGICAL CHANGE THROUGH PRODUCT IMPROVEMENT IN AIRCRAFT TURBINE ENGINES**
Robert Shishko May 1973 88 p refs
(Contract F44620-73-C-0011; Proj. RAND)
(AD-769911; R-1061-PR) Avail: NTIS CSCL 21/5

An area of R and D activity often as important as new product. R and D is R and D directed at improving an existing object, often called product improvement. Multiple regression techniques were used to estimate a multi-dimensional technology tradeoff surface for U.S. aircraft turbine engines. Product-improvement engines embody a higher level of technology than their original versions, but the rate of technological advance is significantly less than the long-run average for new designs. Further, thrust-growth product improvement is subject to diminishing returns with respect to dollar resources. (Modified author abstract) GRA

**N74-17626#** RAND Corp., Santa Monica, Calif.
**HIGH-PERFORMANCE COMPOSITE MATERIALS FOR VEHICLE CONSTRUCTION: AN ELASTOPLASTIC ANALYSIS OF CRACK PROPAGATION IN A UNIDIRECTIONAL COMPOSITE**
Donald F. Adams Mar. 1973 105 p refs
(Contract F44620-73-C-0011; Proj. RAND)
(AD-769867; R-1070-PR) Avail: NTIS CSCL 11/4

A method was developed for predicting the strength of a unidirectional composite material in terms of its micromechanical response to an applied stress. It includes elastoplastic material behavior, local failure that initiates a crack, and propagation of the crack to cause total failure of the composite. GRA

**N74-17648#** Ohio State Univ. Research Foundation, Columbus.
**SUPERSONIC COMBUSTION AND BURNING IN RAMJET COMBUSTORS Final Report, 1 Apr. 1972 - 31 Mar. 1973**
Rudolph Edse, E. E. Rice, and C. T. Kitzmiller Jul. 1973 199 p refs
(Grant AF-AFOSR-1902-70; AF Proj. 9711)
(AD-770061; AFOSR-73-2025TR; SR-3) Avail: NTIS CSCL 21/2

The report contains research results obtained from experimental and theoretical studies of subsonic and supersonic burning in ramjet combustors during the period 1 April 1972 to 31 March 1973. Hydrogen-oxygen mixtures sensitized by chlorine have been ignited photochemically at flow speeds from 350-550 m/s and photochemical ignition limits have been measured at pressures between 100 and 400 mmHg. The formation of weak detonation has been observed. Calculated ignition delay times have been found to agree satisfactorily with experimental values. Tables and graphs have been prepared for quick predictions of the changes resulting from heat addition to an existing sub- or supersonic flow, such as those in ramjet combustors. (Modified author abstract) GRA

**N74-17689#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**TOWARD THE DEFINITION OF ESCAPE AND CAPTURE REGIONS FOR A TWO AIRCRAFT PURSUIT-EVASION GAME M.S. Thesis**
P. H. Cawdery Jun. 1973 78 p refs
(AD-770281; GA/MC/73-4) Avail: NTIS CSCL 15/7

The motivation for the thesis originates in research currently being conducted at the USAF Armament Laboratory, Eglin AFB, Florida. These studies concern the performance of an F4-E aircraft in air-to-air combat; the weapon system considered is an infra-red, heat-seeking missile. The studies fall into two categories: (a) Definition of those regions in the vicinity of a target aircraft which the attacker must penetrate in order to attain a probability of killing his opponent greater than zero; definition of optimal strategies for the attacker to intercept and penetrate the high probability of kill P sub K regions. In all cases, the target aircraft is considered as passive and unaware of attack. This paper makes the logical extension to the above research, and attempts to develop a method by which the capability of the attacker may be defined against an intelligent and evasive target. (Modified author abstract) GRA

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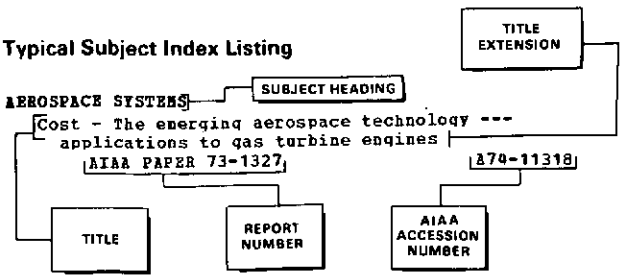


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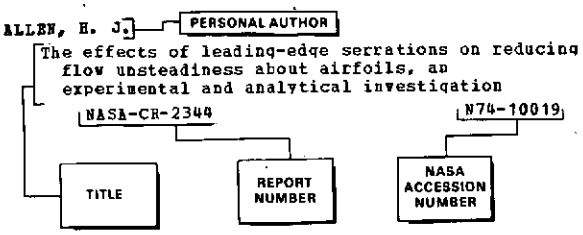


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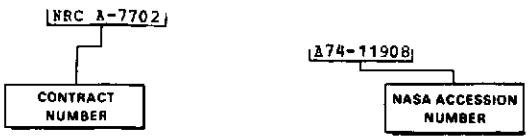


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